VERSION 1 CAPS

GRADE 10
MATHEMATICAL LITERACY

WRITTEN BY VOLUNTEERS

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Siyavula Education

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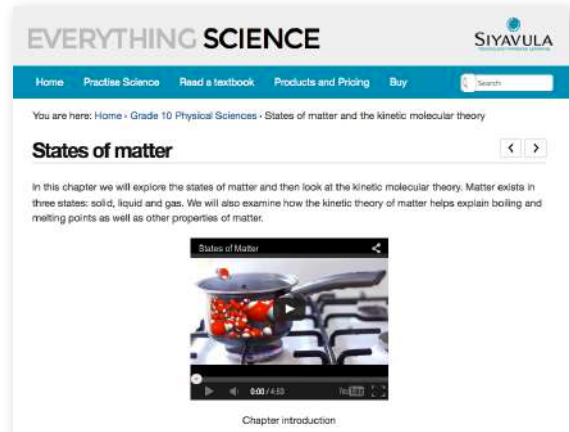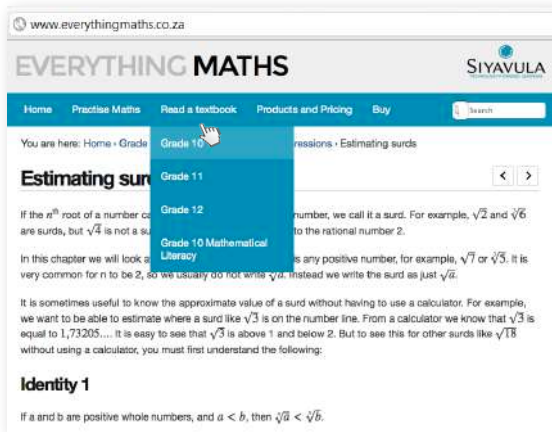
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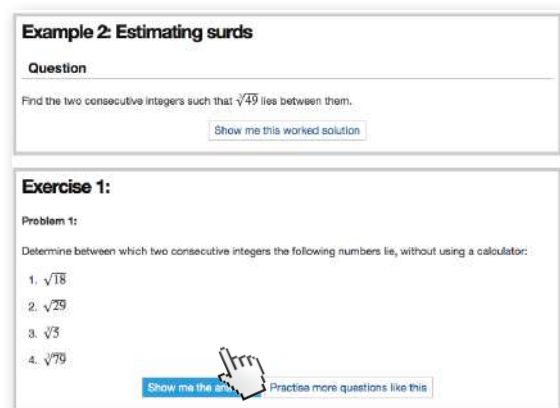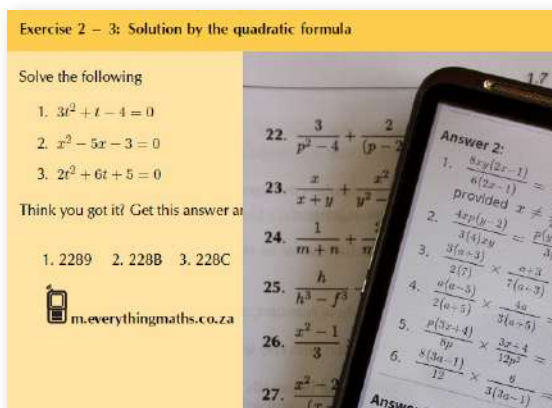
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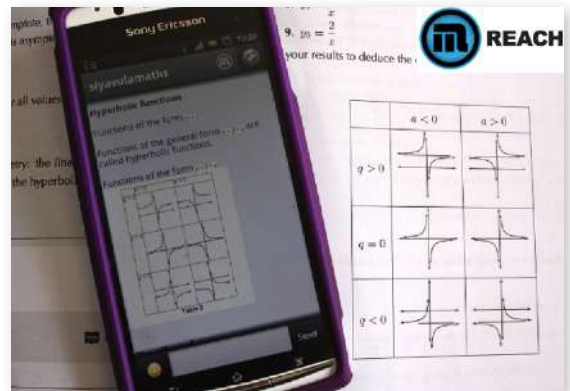
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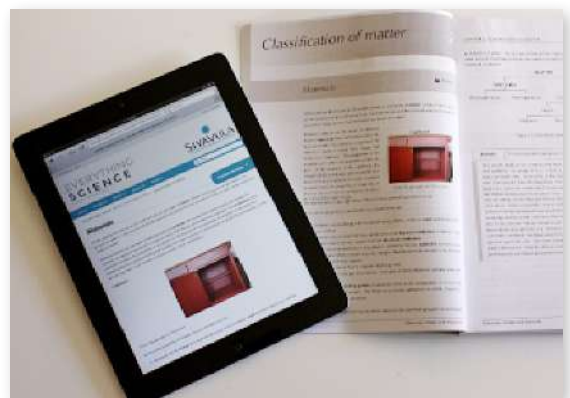
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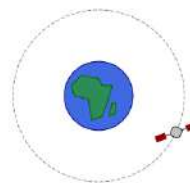
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CHAPTER 1

Numbers and calculations with numbers

1.1 Introduction and key concepts EMG2

Numbers occur all around us in many formats and contexts. For example, your house has a number, you may have a phone number and there are numbers on the till slips you get at the shops. It is important to understand when and how different kinds of numbers are used and to become confident in doing calculations and operations using numbers, in order to understand and navigate your way through everyday situations from cooking to banking!

In this chapter we will learn about:

- number formats and conventions.
- operations using numbers and calculator skills.
- rounding.
- ratios and proportion.
- rates.
- percentages.

1.2 Number formats and conventions EMG3

Ways of representing numbers EMG4

DEFINITION: *Convention*

A standard way of doing something.

DEFINITION: *Format*

The way that something appears or is set out.

Number formats and conventions refer to the different ways that we write numbers.

In South Africa the convention is to use the decimal comma to separate whole numbers from decimal fractions. We use spaces to separate groups of three digits. So we write one million rand as R 1 000 000,00. This makes big numbers easier to read. Compare 3000000 to 3 000 000.

You will sometimes see the use of the decimal point rather than the decimal comma, for example in account statements, bank statements and till slips. Also, sometimes people use commas to separate groups of three digits in very large numbers, for example one million rand is sometimes written as R1,000,000.00. These are all methods

that make numbers easier to read. Using commas to separate groups is not common in South Africa however, and so this convention should be avoided - rather use spaces.

A calculator display shows a decimal point, with no spaces to separate the groups of three digits.

Numbers in different situations EMG5

We use different kinds of numbers in different situations. Sometimes these represent counting numbers or measurement values; sometimes they represent order, and sometimes they are just codes for identification.

Think about the numbers you see around you all the time:

These numbers include:

- measurements, such as lengths and masses.
- numbers of houses and flat numbers, which represent where to find them.
- numbers for counting, such as the number of people on a bus.
- numbers for representing order (for example: Sophie won 1st prize and James won 2nd prize).
- numbers for amounts of money.
- the rate of unemployment, as a percentage.
- numbers that represent a code rather than a value, for example, telephone numbers, car registration plate numbers, PINs, etc.

Notice that the numbers are represented in different ways.

- We use **whole numbers** for counting exact numbers of things, for example, a person has exactly 10 toes.

- Things that are **ordered** in a particular way are given whole numbers, but these numbers do not represent a number value. Ordering of things can also be indicated by 1st, 2nd, 3rd, etc.

- Numbers can also be used to represent **position**. For example, a house or flat number.

Not all of these kinds of numbers can be used in calculations. We can only calculate with numbers that represent a value and not with numbers that are used for naming, ordering or classifying things. For example, it doesn't make sense to use a telephone number in a calculation - if you multiplied a telephone number, you would just get the wrong number!

Activity 1 – 1: Different number formats

1. The numbers below are printed in a American magazine. Write them using our South African conventions:
   a) This new laptop computer can be bought for $1,678.75.
   b) The latest figure for the loss of income is $3,988,620.12.
   c) The population of the country is 42,000,199.
   d) The mass of the new compound is 62.178 g.
2. Write these numbers with spaces to group them correctly:
   a) 53211
   b) 167890
   c) 90001

d) 1123456

e) 4879120

3. Explain why it does not make sense to use a number such as a telephone number in a calculation.

4. Using three or four old magazines or newspapers, cut out examples of different uses of numbers. Stick each example onto a poster, and next to it, write down what the format of the number is, and what the use of that particular number is.

5. Choose one of the following numbering systems and find out more about how the system works, what kinds of numbers are allowed, what the numbers represent, and anything special about the number system. Write two or three paragraphs about what you find out:

   a) the sell-by dates on items in shops.

   b) the South African identity number system.

   c) personal identification numbers (PINs) for cell phones.

   d) the serial number on a cell phone.

   e) the tennis scoring system.

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Writing whole numbers in words EMG6

DEFINITION: *Digit*

One of 0; 1; 2; 3; 4; 5; 6; 7; 8; 9; used to make up a number.

To convert a number that is written in digits into words, use the following method:

- Beginning at the right and working from right to left, separate the number into groups by inserting spaces after every three digits (e.g. "123456" becomes "123 456").
- Beginning at the left, read each group individually, saying the name of the group.

Here are a few examples for writing the numbers as words.

Worked example 1: Grouping large numbers and writing them in words

QUESTION

1. Write out 42958 in words.
2. Write out 307991343 in words.

SOLUTION

1. a) Beginning at the right, we can separate this number into groups of digits by putting a space between the 2 and 9, which is 42 958.

   b) Beginning at the left, we read each group individually:

   - Thousands group: _ 4 2 → Forty-two thousand,
   - Units group: 9 5 8 → Nine hundred and fifty-eight.

   Solution: Forty-two thousand, nine hundred and fifty-eight.

2. a) Beginning at the right, separate this number into groups of digits by putting spaces between the 1 and 3, and the 7 and 9, which gives us 307 991 343.

   b) Beginning at the left, read each group individually.

   - Millions group: 3 0 7 → Three hundred and seven million,
   - Thousands group: 9 9 1 → Nine hundred ninety-one thousand,
   - Units group: 3 4 3 → Three hundred and forty-three.

   Solution: Three hundred and seven million, nine hundred and ninety-one thousand, three hundred and forty-three

Place value of large numbers EMG7

It is easier to read large numbers written in symbols than numbers written out in words, because the place value of the symbols makes the value of the number clear.

For example: 65 781 is written out in full as sixty-five thousand, seven hundred and eighty-one.

Note the comma after the thousands and the hyphen between the tens and the units. This is similar to the thousands space we use when writing numbers in numerals.

It is useful to write large numbers in a place value table to compare them:

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Units

Worked example 2: Finding place value

QUESTION

What is the place value of the 9 in each of these numbers?

1. 891 034
2. 119 222
3. 123 239
4. 6 901 333

SOLUTION

Write the numbers in separate columns or in a table.

Write the place value in the top row:

	M	H Th	T Th	Th	H	T	U
1.		8	9	1	0	3	4
2.		1	1	9	2	2	2
3.		1	2	3	2	3	9
4.	6	9	0	1	3	3	3

1. Ten Thousands
2. Thousands
3. Units
4. Hundred Thousands

Arranging numbers in order EMG8

Here is a method for writing whole numbers from smallest to biggest (ascending order):

- Draw up a table with enough place value columns for all of the digits.

- Write in all the numbers. Put the units in the column on the right-hand side.
- Compare all of the numbers, starting from the first column on the left.
- If the digits are the same, look at the next column to the right until you find a digit that is different from the others.
- Write down the smallest number first, then the next smallest, and so on.

Worked example 3: Writing numbers from smallest to biggest (ascending)

QUESTION

Write these numbers in order from smallest to biggest.

41 388; 444 697; 414 230; 14 000 021

SOLUTION

TM	M	HTh	TTh	Th	H	T	U
			4	1	3	8	8
		4	4	4	6	9	7
		4	1	4	2	3	0
1	4	0	0	0	0	2	1

You can see at a glance from the table that 41 388 is the smallest number, as its largest place value digit is only TTh (ten thousands).

So we write down 41 388; . . .

Then we compare 444 697 and 414 230. In the TTh column, we see that 444 697 is larger than 414 230.

So we write down 41 388; 414 230; 444 697; . . .

The largest number is clearly 14 000 021, as it is the only number that has digits in the millions group.

The numbers from smallest to biggest are: 41 388; 414 230; 444 697; 14 000 021.

We use a similar method for writing numbers from biggest to smallest (descending order): compare them in the same way and write down the biggest number first.

Activity 1 – 2: Place value and ordering numbers

1. Write out each number in words:
   a) 12 341
   b) 202 082 003
   c) 1 000 010

2. Write the following words as numbers:
   a) Four hundred and sixty thousand, five-hundred and forty-two.
   b) Fourteen million, sixteen thousand and seven.
   c) Three billion, eight-hundred and three thousand.

3. Write the following numbers in order from biggest to smallest:
   a) 161 280; 600 765; 1 653 232; 1 694 212; 612 005
   b) 888 024; 188 765; 1 808 765; 818 123; 82 364
   c) 315 672; 333 289; 3 233 987; 3 402 987; 3 325 999

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1\. 2482   2. 2483   3. 2484

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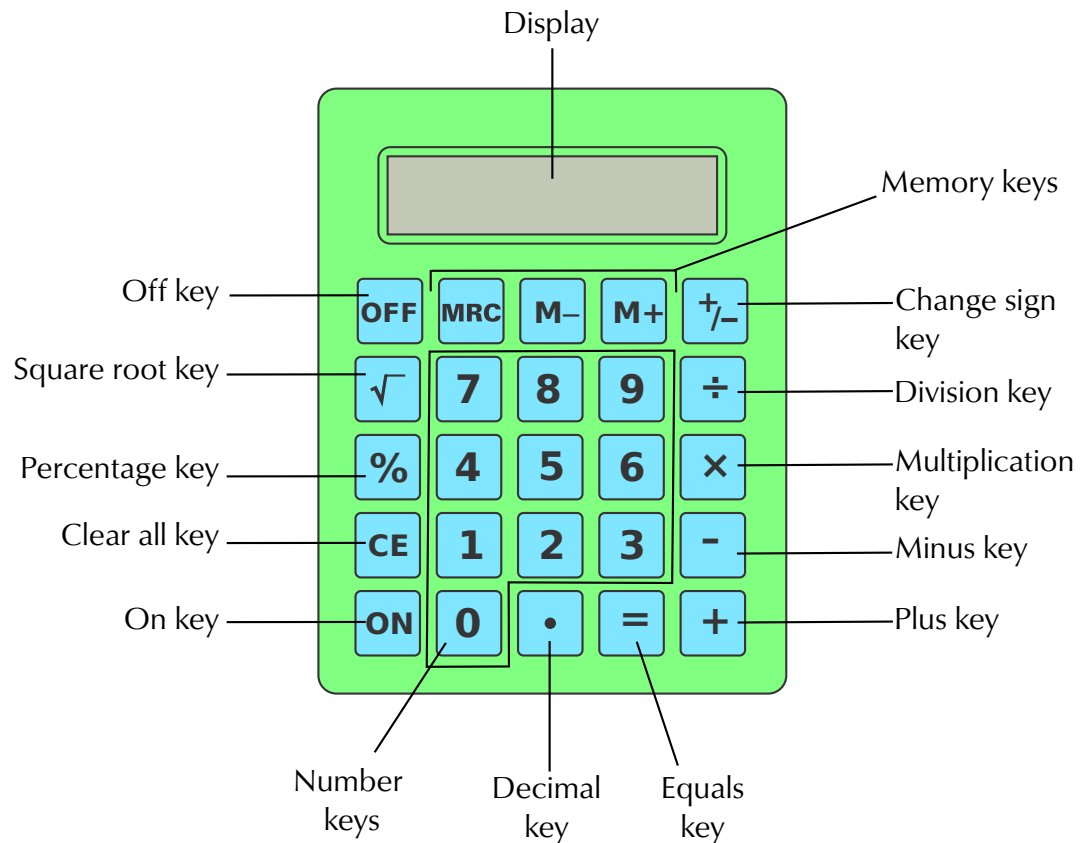
1.3 Operations using numbers and calculator skills EMG9

Estimating EMGB

Estimating answers to calculations is a very important step for two reasons:

- it helps you to think about a problem before working it out.
- it helps you to check your answers.

With practice, you can estimate answers quickly!

Basic calculators usually have these parts:

How to use the memory keys on your calculator

The memory keys (M+, M−, and MRC) allow you to do calculations in the calculator's memory (check what the equivalent keys are on your own calculator).

- The M+ key is used to add a number to the memory, or to add it to a number already in the memory.
- The M− key is used to subtract a number from the number in memory.
- If you press the MRC key once, the calculator displays the number stored in memory. If you press this key twice, the calculator's memory is cleared.
- When you use a memory key, the letter 'M' appears at the top of the display screen, showing that the number on the display has been stored in the calculator's memory.

This means that we can do longer calculations without having to write down the steps in between. It also gives you a way of doing calculations in the right order. Let's see how this works.

Worked example 4: Using the memory keys on your calculator

QUESTION

Give the correct calculator key sequence to solve: $200 + (2 \times 80) - 60$.

SOLUTION

Enter 200 into calculator and add it to the memory by pressing M+.

Calculate 2×80 and add it to the memory by pressing M+.

Then enter 60 and subtract it from the memory by pressing M−.

Press MRC to show the answer stored in the memory: 300.

So the complete sequence of keys will be: 200 [M+] 2 [×] 80 [M+] 60 [M−] [MRC].

Compare the key sequence in the previous example to the key sequence: $200 + 2 \times 80 - 60$. The memory key allows you to work without brackets.

NOTE:
Always clear the calculator's memory by pressing MRC twice, otherwise you will end up with unexpected answers.

Changing the sign of numbers

Practise changing the sign of a number on your calculator. For example, changing 10 to −10. Some calculators have a [±] key, which changes the sign of a number.

If you see ± (plus-minus) written before a number in other situations, it means the number is only approximate. It is only on the calculator that this key refers to a function that changes the sign of the number.

Activity 1 – 3: Practise using your calculator

1. Does your calculator have keys that are not shown on the calculator above? If so, find out what they do and write this down.
2. What is the highest number you can display on your calculator? Write it out in words.
3. Explore the difference between the "clear" keys on your own calculator.
4. Which of the following keys does your calculator have: [AC]; [CE]; [C] [ON/C] ?
5. Press 9 [+] 5 . Then press [CE]. Now press [+] 1 [×] 100 [=]. Write down your answer.
6. Press 9 [+] 5. Then press the ordinary clear key [C], or [ON/C] or [ON]. Now press [+] 1 [×] 100 [=]. Write down your answer.

7. Why do you get different answers for the previous two questions?

8. If there are other clear keys on your calculator, find out how they work by following the same steps.

9. Which of these key sequences do not give you -1000 on the display?

   a) [–] 2000 [+] 1000 [=]
   b) 1000 [+] 2000 [±] [=]
   c) 10 [×] 100 [±] [=]
   d) [±] 10 [×] 100 [=]
   e) 1000 [–] 2000 [=]
   f) 1000 [±] [–] 2000 [±] [=]
   g) 4000 [± [+] 3000 [=]
   h) 4000 [± [+] 3000 [±] [=]

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7. 248C 8. 248D 9. 248F

The order of operations and brackets EMGD

Vaneshri makes hand-crafted toys and sells them at three market stalls. She wants to calculate the amount of profit received by her business after the rental costs. Her initial profit is R 40 000. Each stall costs her R 2000 in rental. She does the following calculation on her calculator:

$40\ 000 - 2000 \times 3 = 114\ 000$

She is very puzzled. How can she have more profit than she started with?

The calculator does the calculations in exactly the same order as they are keyed in:

$$40\ 000 - 2000 = 38\ 000$$
$$38 \times 3 = 114\ 000$$

This means that she was multiplying the remaining profit by 3, rather than just the rental!

In this context, however, Vaneshri wanted to find the total rental for the 3 stalls (2000×3) and then subtract that from 40 000, getting an answer of R 34 000.

There are two ways to make sure that you get the order of operations right. In the following section we will learn about how they work.

Brackets

We can use brackets to show the order in which operations happened in the situation. We want to show that Vaneshri should multiply the stall rental by 3 before subtracting it from the profit:

$40\ 000 - (2000 \times 3) = 34\ 000$

BODMAS

If there are no brackets in a calculation, we use the BODMAS rule to remember in which order we must perform operations. This is a rule which says what the order must be:

B → Brackets ()

O → Of or orders: powers, roots, etc.

D, M } → Division and multiplication

A, S } → Addition and subtraction

If there are brackets involved then we must do the operation in the brackets first; then do the multiplication or division (it doesn't matter what the order is); and last, do the addition or subtraction (in any order).

Worked example 5: The order of operations

QUESTION

Kepa wrote this number sentence to show the cost of some clothes that he bought:

Cost $= 4 \times \text{R } 160 + 5 \times \text{R } 85$

Work this out using the correct order of operations.

SOLUTION

Using BODMAS, we need to calculate the multiplication parts before the addition parts.

$$\begin{aligned}\text{Cost} &= 4 \times \text{R } 160 + 5 \times \text{R } 85\\ &= \text{R } 640 + \text{R } 425\\ &= \text{R } 1065\end{aligned}$$

Using brackets makes this easier to see, but they are not necessary:

$$\begin{aligned}\text{Cost} &= (4 \times \text{R } 160) + (5 \times \text{R } 85)\\ &= \text{R } 640 + \text{R } 42\\ &= \text{R } 1065\end{aligned}$$

Addition and multiplication shortcuts to make calculations easier EMGF

Let's look at some addition and multiplication tricks that help us to calculate quickly and easily, without a calculator. These don't usually apply to subtraction and division.

Remember that we can do addition in any order, for example, $100 + 15 = 15 + 100$

The same applies to multiplication: $20 \times 6 \times 8 = 8 \times 6 \times 20$.

This is useful, because sometimes we can rearrange the order of a calculation to make it easier. We will see how this works below.

Breaking down and multiplying

Breaking down numbers before multiplying is a useful trick for doing mental multiplication quickly. It is a rule that states that you can multiply a large number directly, or break it up into parts and multiply each part, and then add the answers together again. You will get the same answer either way.

For example, if you need to work out 4×57 quickly:

$$\begin{aligned} 4 \times 57 &= 4 \times (50 + 7) \text{ (Break up the number 57)} \\ &= (4 \times 50) + (4 \times 7) \text{ (Distribute over the parts of 57)} \\ &= 200 + 28 \\ &= 228 \end{aligned}$$

It is easy to calculate $(4 \times 50) = 200$ and $(4 \times 7) = 28$ mentally, so you can do the whole calculation without writing it down.

When doing these calculations, look for ways to change the calculation so that you are multiplying by a multiple of ten, or using the multiplication tables that you can do mentally. Sometimes turning a number into a subtraction calculation helps.

Let's see how this rule works in the following examples.

Worked example 6: Breaking down and multiplying

QUESTION

Use breaking down and multiplying to do the following calculations quickly without a calculator.

1. How much would it cost to buy 14 CDs at R 121 each?
2. How many seats are there in a stadium if there are 19 rows of 130 seats in each row?
3. A school wants to buy 14 computers for the computer lab at R 10 300 each. How much will it cost them in total?

SOLUTION

1.

$$\begin{aligned} 121 \times 14 &= 121 \times (10 + 4) \\ &= (121 \times 10) + (121 \times 4) \\ &= 1210 + 484 \\ &= 1694 \end{aligned}$$

OR

$$\begin{aligned}(100 + 20 + 1) \times 14 &= (100 \times 14) + (20 \times 14) + (1 \times 14)\\ &= 1400 + 280 + 14\\ &= 1694\end{aligned}$$

The CDs will cost R 1694.

2.

$$\begin{aligned}130 \times 19 &= 130 \times (20 - 1) \text{ (19 is very close to 20, so let's write it as (20 - 1))}\\ &= (130 \times 20) - (130 \times 1)\\ &= 2600 - 130\\ &= 2600 - 100 - 30\\ &= 2500 - 30\\ &= 2470\end{aligned}$$

There are 2470 seats in the stadium.

3.

$$\begin{aligned}10\ 300 \times 14 &= 10\ 300 \times (10 + 4)\\ &= (10\ 300 \times 10) + (10\ 300 \times 4)\\ &= 103\ 000 + 41\ 200\\ &= 144\ 200\end{aligned}$$

OR

$$\begin{aligned}10\ 300 \times 14 &= (10\ 000 \times 14) + (300 \times 14)\\ &= 140\ 000 + 4200\\ &= 144\ 200\end{aligned}$$

The computers will cost R 144 200 altogether.

Using grouping

Grouping numbers in different ways can also help us to multiply and add quickly.

There is a rule that states that in a calculation that only contains addition operations, we can group addition calculations in any order, and similarly, in a calculation that only contains multiplication operations, we can group the calculations in any order.

This helps us, because if we rearrange the numbers, we might find that we can do calculations by just looking at them!

In a calculation such as $25 \times 13 \times 4$, it is easier to rewrite this as $25 \times 4 \times 13$ because this becomes $(25 \times 4) \times 13 = 100 \times 13 = 1300$.

Worked example 7: Using grouping to make calculations easier

QUESTION

1. There are 25 crates in a shipping container. Each crate contains 4 boxes of 32 ornaments. Using grouping, find an easier way to calculate $25 \times (32 \times 4)$.

2. Use grouping to calculate the cost of 36 books at R 25 each (hint: think of 36 as 9×4).
3. A DVD costs R 250. Ibrahim sells 32 of these in one day. How much money does he earn?

SOLUTION

1. $25 \times (32 \times 4) = (25 \times 4) \times 32$, which is $100 \times 32 = 3200$
2. R $36 \times 25 = 9 \times 4 \times 25 = 9 \times 100 =$ R 900
3. First we break 32 into 4×8

   R $250 \times 4 \times 8 =$ R $1000 \times 8 =$ R 8000

Multiplying by 10, 100 and 1000 without a calculator

Another trick to keep in mind is how we multiply whole numbers by 10, 100 and 1000.

- To multiply by 10, every digit moves to the left by one decimal place, and a zero moves into the units position.
- To multiply by 100, every digit moves to the left by two decimal places, and two zeros move into the tens and units positions.
- To multiply by 1000, every digit moves to the left by three decimal places, and three zeros move into the hundreds, tens and units positions.

It is useful to do these calculations in a place value table, or in columns.

Worked example 8: Multiplying by 10, 100 and 1000

QUESTION

1. Multiply 39 103 by 10.
2. Multiply 5592 by 100.
3. Multiply 123 by 1000.
4. Multiply 7801 by 1000.

SOLUTION

M	H Th	T Th	Th	H	T	U
	3	9	1	0	3	0
	5	5	9	2	0	0
	1	2	3	0	0	0
7	8	0	1	0	0	0

1. 391 030
2. 559 200
3. 123 000
4. 7 801 000

NOTE:
We deal with this again and also with division by 10, 100 and 1000 in the section on decimal fractions.

Activity 1 – 4: Using various methods to simplify calculations

1. Solve the following, using grouping and brackets to make your calculations easier:
   a) 113×35
   b) 16×71
   c) 40×42
   d) 98×25
   e) 105×31
   f) 32×84

2. Solve the following, using breaking down and grouping to make your calculations easier:

   a) $145 + 193 + 55$
   b) $67 + 143 + 123$
   c) $264 + 1003 + 136$
   d) 48×250
   e) 125×72
   f) 35×200

3. Calculate the following, using BODMAS:

   a) $14 + (80 - 17) \times 10 + 1$
   b) $9 + 4 \times 6 - 2$
   c) $2 + 3 + 100 - 7 \times 7$
   d) $15 + 2(26 \div 2) - 20$

4. Rewrite these calculations with brackets, in order to make the answers correct:

   a) $8 + 6 \times 5 = 70$
   b) $8 + 6 \times 5 = 38$
   c) $8 + 3 \times 8 - 2 = 66$
   d) $8 + 3 \times 8 - 2 = 30$
   e) $15 + 2 \times 5 - 2 = 23$
   f) $15 + 2 \times 5 - 2 = 51$
   g) $15 + 2 \times 5 - 2 = 21$

5. Multiply each of the following numbers by i. 10, ii. 100 and iii. 1000:

   a) 14
   b) 609
   c) 210
   d) 10 001

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1. 248G 2. 248H 3. 248J 4. 248K 5. 248M

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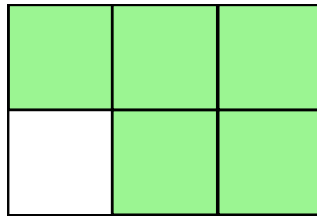
Common fractions EMGG

A fraction is a measure of how something is divided into parts.

5 → numerator

6 → denominator

The fraction $\frac{5}{6}$ means five parts out of a total of six parts, where the whole is divided into 6 parts.

This is called a **common** fraction. The numerator and the denominator are both whole numbers and they are separated by a line that represents division.

In real life this means five parts out of six, like five people out of a group of six people.

Common fractions are called **proper** fractions when the numerator is smaller than the denominator, e.g. $\frac{2}{10}$ or $\frac{3}{5}$.

When the numerator is bigger than the denominator, the fraction is called an **improper** fraction, e.g. $\frac{10}{2}$ or $\frac{5}{3}$.

When we convert improper fractions to whole numbers with a fraction they are called **mixed numbers**, e.g. $\frac{9}{2} = 4\frac{1}{2}$ and $\frac{4}{3} = 1\frac{1}{3}$.

Operations with fractions EMGH

Adding and subtracting fractions

If you don't use a calculator, you first need to make sure that all fractions have the same denominator before you add or subtract them. Using a calculator often makes calculations with fractions much easier.

Two different methods for adding or subtracting fractions are given below. The method you choose depends on whether you want a common fraction or a decimal fraction as the answer.

Method 1:

To keep your answer as a common fraction, you need to change the denominators of all the fractions you are adding or subtracting to be the same.

- First multiply the denominators together to find a common denominator that will work for all of the fractions. Try to simplify it to make the calculations easier, but remember, it must still be a multiple of all of the original denominators. This demoninator is called the **lowest common denominator** (LCD).
- Next multiply the numerator of each fraction by the same number you multiplied with the denominator to get the LCD. (e.g. if the original denominator of a fraction is 3, and the LCD of the group of fractions is 6, we multiply the numerator by 2, because $3 \times 2 = 6$).

For example, how much is $\frac{1}{2} + \frac{1}{3} + \frac{1}{6}$?

$2 \times 3 = 6$, so 6 is a common denominator for all three fractions.

Next we multiply each fraction's numerator by $\frac{\text{LCD}}{\text{denominator}}$

$$
\begin{aligned}
&\frac{1}{2} + \frac{1}{3} + \frac{1}{6} \\
&= \frac{(1 \times \frac{6}{2}) + (1 \times \frac{6}{3}) + (\frac{6}{6})}{6} \\
&= \frac{(1 \times 3) + (1 \times 2) + 1}{6} \\
&= \frac{6}{6} \\
&= 1
\end{aligned}
$$

Method 2:

Treat each fraction like a separate division calculation, e.g. $\frac{4}{5} = 4 \div 5$.

Put the answers of the division calculations into the calculator's memory.

Add to or subtract from the memory and press MRC to find the answer.

Let's put this all together in some worked examples. These look quite complicated, but if you work through them step-by-step, you will see how they work!

Worked example 9: Simplifying fractions

QUESTION

Simplify the following without a calculator and then calculate the decimal answer, using your calculator (round your answer to 2 decimal places):

1. $\frac{3}{4} + \frac{3}{5} - \frac{3}{10}$
2. $10\frac{1}{7}$

SOLUTION

1. **Without** a calculator:

$$\frac{3}{4} + \frac{3}{5} - \frac{3}{10}$$
$$= \frac{(3 \times 5)}{20} + \frac{(3 \times 4)}{20} - \frac{(3 \times 2)}{20}$$
(The smallest multiple of 4, 5 and 10 is 20 so 20 is the LCD)
$$= \frac{15}{20} + \frac{12}{20} - \frac{6}{20}$$
$$= \frac{21}{20}$$
$$= 1\frac{1}{20}$$

With a calculator:
Key sequence:
3 [÷] 4 [=] [M+]
3 [÷] 5 [=] [M+]
3 [÷] 10 [=] [M−] [MRC]
=1,05

Note: Remember to press [MRC] twice once you have written your answer down.

2. **Without** a calculator:
$10\frac{1}{7} = \frac{70}{7} + \frac{1}{7} = \frac{71}{7}$
With a calculator:
Key sequence:
10 [×] 7 [+] 1 [=] [÷] 10 [=] [M+]
=10,14285...
Round off 10,14285... to the second decimal place = 10,14

Decimal fractions EMGJ

What is a decimal fraction?

Think back to place value: Thousands; Hundreds; Tens and Units.

$1000 \div 10 = 100$
$100 \div 10 = 10$
$10 \div 10 = 1$
$1 \div 10 = 0{,}1$

The bar below has been divided into ten equal parts; 1 is divided into 10. We say that 0,1 is one tenth. It is the only way in which calculators can write one tenth.

We have found that $1 \div 10 = 0{,}1$.

Think back to fractions:

$$1 \div 2 = \frac{1}{2}$$
$$\text{So } 1 \div 10 = \frac{1}{10}$$
$$1 \div 10 = \frac{1}{10} = 0{,}1$$

0,1 is just another way of writing $\frac{1}{10}$.

Worked example 10: Working with decimal fractions

QUESTION

What numbers are written in each row of this place value table?

Thousands	Hundreds	Tens	Units	tenths $\frac{1}{10}$
7	1	9	3	6
5	0	6	9	1

SOLUTION

- $7193,6 = 7 \times 1000 + 1 \times 100 + 9 \times 10 + 3 \times 1 + \frac{6}{10}$
- $5069{,}1 = 5 \times 1000 + 0 + 6 \times 10 + 9 \times 1 + \frac{1}{10}$

NOTE:
We use a decimal comma to show the end of the whole number and the beginning of the decimal fraction.

Remember:

- when we multiply by 10, 100 or 1000, we count the number of zeros and move the decimal comma the same number of places to the right.
- when we divide by 10, 100 or 1000, we count the number of zeros and move the decimal comma the same number of places to the left.

Look at the example in the place value table below:

HTh	TTh	Th	H	T	U	t	h	
			2	8	7	, 5		
		2	8	7	, 5			× 10
	2	8	7	, 5				× 100
2	8	7	, 5					× 1 000

Activity 1 – 5: Working with decimal fractions

1. Write the following decimal numbers under the correct heading in the columns below:

   a) 1456,3
   b) 4601,91
   c) 8,05
   d) 31,7
   e) 456,2

	Thousands	Hundreds	Tens	Units	tenths	hundredths
a)						
b)						
c)						
d)						
e)						

2. Carefully consider the value of each digit and use the correct sign <, = or > to compare the following:

   a) 1,5 ____ 1,7
   b) 45,9 ____ 62,3
   c) 6,3 ____ 6,1
   d) −13,2 ____ 8,6
   e) 24,7 ____ 42,3
   f) −57,5 ____ −58,2

3. Circle the largest number: 43,7; 41,9; 43,1; 49,1; 41,5
4. Write down the number that is:
   a) one more than 9,9
   b) 0,1 less than 7,1
   c) 0,1 more than 5,3
   d) 0,1 less than 99,0
   e) 0,1 less than 63,3
   f) 0,1 more than $-5,8$
   g) 0,1 less than $-8,3$
   h) 0,1 less than 10
5. Do the following calculations without using a calculator:
   a) $42,5 + 83,4$
   b) $52,5 + 75,35$
   c) $26,4 - 25,1$
   d) $72,9 - 65,6$
   e) $2,3 \times 0,2$
   f) $1,2 \times 100$
   g) $3,4 \times 1000$
   h) $324,3 \times 10$
   i) $724,3 \times 100$
   j) $5,298 \times 100$
   k) $375,86 \div 1000$
   l) $274,57 \div 100$
   m) $62,5 \div 1000$

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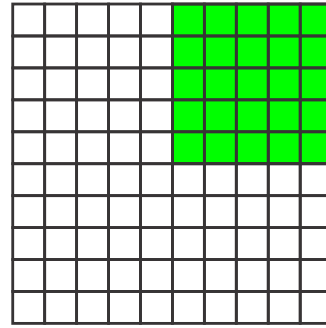
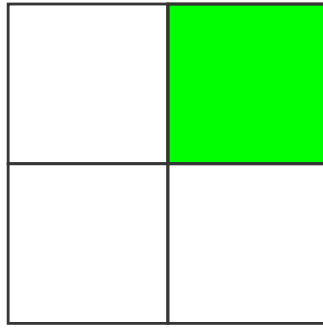
1. 248N 2. 248P 3. 248Q 4. 248R 5. 248S

Converting between fractions and decimal fractions

To write a common fraction as a decimal fraction, we can use some different methods. First, we can convert the fraction to a fraction with a denominator of 10, 100 or 1000. For example, $\frac{1}{4} = \frac{25}{100} = 25\%$.

How do we write fractions like thirds and sixths as decimal fractions? We can't write them with denominators of 10, 100 or 1000. Instead, we use division.

Worked example 11: Converting common fractions to decimal fractions

QUESTION

Write these as decimal fractions:

1. $\frac{2}{3}$
2. $\frac{3}{5}$

SOLUTION

1. We can't write this as a fraction of 10, 100 or 1000. So we calculate $2 \div 3 = 0{,}6666\ldots$ This is called a recurring decimal, as it repeats over and over again.
2. $\frac{3}{5} = \frac{6}{10} = 0{,}6$

Activity 1 – 6: Converting between fractions and decimal fractions

1. **Using a calculator**, write each of these as decimal fractions.
   a) $\frac{3}{4} = 3 \div 4 =$
   b) $\frac{2}{5} = 2 \div 5 =$
   c) $\frac{3}{5} =$
   d) $\frac{4}{5} =$
   e) $\frac{5}{5} =$
   f) $\frac{1}{4} =$
2. Convert one-third into a decimal: $\frac{1}{3} = 1 \div 3 =$ ____

3. **Without a calculator**, write down equivalent fractions for each of the following and then write them as decimal fractions:

Fraction	Fraction as tenths	Decimal fraction
two-thirds	Can't	
one-quarter		
three-quarters		
one-fifth		
two-fifths		
three-fifths		
four-fifths		
one-sixth	Can't	
one-eighth		

(Some of the above have more than one decimal place but it is good to know about them.)

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1. 248T 2. 248V 3. 248W

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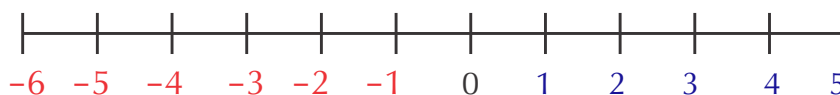
Positive and negative numbers EMGK

Negative numbers are numbers that are smaller than zero. Although they are obvious to us, people only started using negative numbers in the late middle ages. If we didn't include negative numbers, there would be many subtraction calculations that we couldn't do.

A number line helps us to understand negative numbers. We can place 0 on a number line and then numbers 1 to 5 to the right of the 0.

Now think about a point that is one unit space to the left of the 0 point. We cannot call this point 1, as there is already a point called 1. We therefore call this point -1 (or minus one), as it is one unit to the **left** of 0.

Notice that the plus and minus signs now have two meanings:

- The plus sign can indicate addition or a positive number.
- The minus sign can indicate subtraction or a negative number.

To avoid any confusion between "sign" and "operation," rather read the sign of a number as "positive" or "negative." When "+" is used as an operation sign, read it as "plus." When "−" is used as an operation sign, read it as "minus."

Positive and negative numbers as opposites

Every positive number has an opposite negative number on the other side of zero. If you add these two numbers together, the answer is zero.

For example, $4 + (-4) = 0$. This is the same as subtracting 4 from 4.

Activity 1 – 7: Fractions, decimal fractions and positive and negative numbers

1. Share 11 sausage rolls equally among 10 learners. How much sausage roll will each learner receive?

2. Share 12 sausage rolls equally among 10 learners. How much sausage roll will each learner receive?
3. Mike drinks $1\frac{1}{2}$ mugs of milk at breakfast. His sister, Sharon, drinks $\frac{3}{4}$ of a mug of milk. How much milk do they drink altogether?
4. Write the following numbers in a place value table:
   a) 64,8
   b) 341,2
   c) 6909,9
5. Write as decimals:
   a) Three and four-fifths =
   b) One and three-tenths =
   c) Five and one-quarter =
   d) $4\frac{1}{2} =$
6. From $<$; $>$; = write down the correct sign to make the following true:
   a) 2,4 ____ 4,2
   b) 1,7 ____ 2,1
   c) $-10{,}6$ ____ $-9{,}2$
   d) $-2{,}34$ ____ $-5{,}4$
7. Write down the number that is:

a) one tenth more than 45,9

b) one tenth less than 10

8. Funeka's bank balance is −R 2000. Then she deposits her monthly salary into the account. Her new balance is R 4000. How much is her salary?

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1. 248X 2. 248Y 3. 248Z 4. 2492 5. 2493 6. 2494
7. 2495 8. 2496

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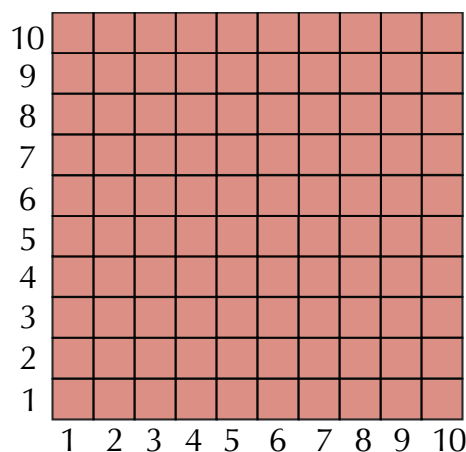
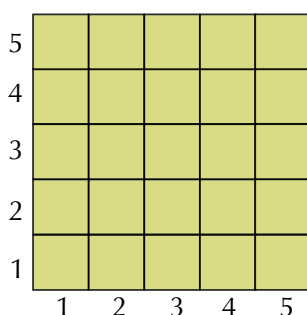
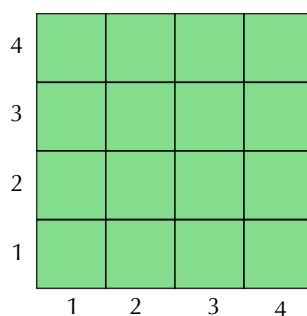
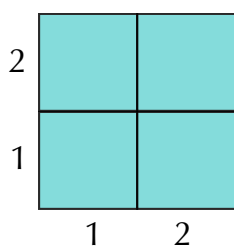
1.4 Squares, square roots and cubes EMGM

Squares EMGN

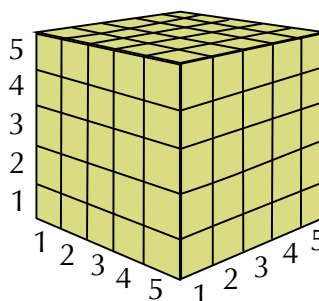
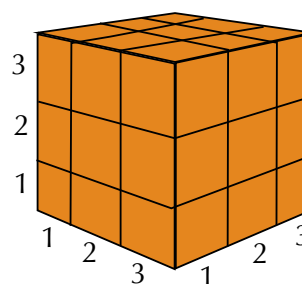
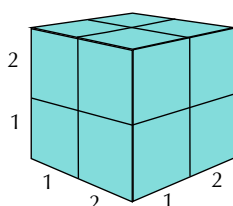
The square of a number is the number multiplied by itself. We can represent squares of numbers in diagrams. The number of blocks along the side of the square is the number that is being squared. The total number of small squares in each diagram is equal to the square of the number.

Notice that the **area** of a square is equal to the side squared. 2×2 squares $= 2^2 = 4$ squares in total, 4×4 squares $= 4^2 = 16$ squares in total and so on. You need to know how to square numbers in order to work with area in later chapters.

Square roots EMGP

In each case, the number that is squared is the square root. So the square root of the diagram representing 4^2 and is equal to 4. We can write this as $\sqrt{16} = 4$.

Notice that finding the square root of a number is the same as finding the side of the square. It is the opposite to squaring the number.

Cubes EMGQ

In the same way, a number to the power of three is called the cube of the number. So 3^3 is $3 \times 3 \times 3$, or three cubed and is equal to 27. The length of each side is equal to the number that is cubed.

To square a number, multiply it by itself, e.g. $2 \times 2 = 2^2 = 4$.

To cube a number, multiply it by itself twice, e.g. $2 \times 2 \times 2 = 2^3 = 8$.

It is also easy to work out square roots on your calculator; simply enter the number and then the square root key.

Activity 1 – 8: Squares, square roots and cubes

1. Use you calculator to work out the following squares:

   a) 200^2

   b) 413^2

   c) 3100^2

   d) 2567^2

2. A tile shop has tiles of various sizes for sale. Calculate the length of the sides of square tiles with the following areas:

   a) 121 cm^2
   b) 625 cm^2
   c) 400 cm^2
   d) 14 400 mm^2

3. Calculate the volumes of cubes which have sides of these lengths:

   a) 14 mm
   b) 28 mm
   c) 105 mm
   d) 81 cm

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1. 2497 2. 2498 3. 2499

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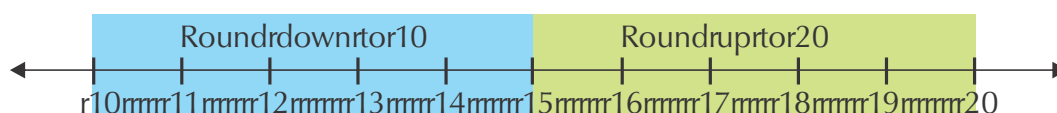
1.5 Rounding EMGR

Rounding off according to the context EMGS

When we round off numbers, we need to be aware of the context of the problem. This will determine whether we round off, up or down.

When we round off to the nearest 10, we follow the simple rule that numbers with units digits from 1 to 4 are rounded **down** to the lower ten, while numbers with units digits from 5 to 9 are rounded **up** to the higher ten.

However, when we are working in some practical, real-life situations, we must think carefully about what the results of rounding off will be. In other words, the answer must be reasonable so that it is not only correct, but also makes sense in the situation.

For example, South Africa no longer has 1c and 2c coins, so shops need to round off the totals to a 5c value if customers are paying cash. Shops round down, rather than rounding off. So if your total is R 13,69, you would pay R 13,65 in cash. If you pay by credit or debit card however, the totals are not rounded off.

Worked example 12: Rounding up and down

QUESTION

Answer the following questions and in each case explain why you would round up or down to get a reasonable answer.

1. Jacolene is catering for a group of 54 people. The muffins are sold in packs of 8. How many packs of muffins must she buy?

A group oflearners is going to the Maropeng Centre at the Cradle of Humankind. There are 232 learners and teachers going on the outing. The school needs to hire buses and each bus can carry 50 passengers.

2. a) How many buses should they hire?
   b) How many empty seats will there be?

3. Ludwe is buying blinds for a large window in his home. Each blind is 100 cm wide. The window is 260 cm wide. How many blinds does he need?

SOLUTION

1. Jacolene has to decide whether to round up and buy $7 \times 8 = 56$ muffins, so that there will definitely be enough for each person to have one, or whether it is unlikely that everyone will want a muffin, in which case she can round down to $6 \times 8 = 48$ muffins.

2. a) To make sure that no learners are left behind, we have to round the number of seats up to the next 50, so 232 is rounded up to 250, and there must be 5 buses.
   b) There will be 250 - 232 = 18 empty seats.

3. In this situation, Ludwe will probably round up again, as it would be a problem to have a part of the window exposed, and more acceptable to have the blinds wider than the window width. So he would round up the total width of blinds to 300 cm, so that there would be 3 blinds in total.

Activity 1 – 9: Rounding off in real-life situations

1. Michael needs 1245 tiles to tile a bathroom. He can only buy tiles in packs of 75.

    a) Should he round the number of tiles up or down to see how many he should buy? Explain.

    b) How many packs should he buy?

2. A classroom wall is 750 cm long.

    a) How many tables, each 120 cm long, will fit along the wall?

    b) How much space will be left over?

3. There are 231 learners in a Grade 10 group. They each need an exercise book, which are sold in packs of 25.

    a) How many packs of books should be ordered?

    b) How many spare exercise books will there be?

4. Julia needs to make 500 hamburgers for a school function. Hamburger patties are sold in packets of 12.

    a) How many packets of patties should she buy?

    b) How many will be left over?

5. Car parking spaces should be 2,5 m wide. How many parking spaces should be painted in a car park which is 72 m wide?

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1. 249B 2. 249C 3. 249D 4. 249F 5. 249G

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1.6 Ratio, rate and proportion EMGT

What is a ratio? EMGV

A ratio is a comparison of two or more numbers that are usually of the same type or measurement. If the numbers have different units, it is important to convert the units to be the same before doing any calculations.

We write the numbers in a ratio with a colon (:) between them.

For example, if there are 8 learners who travel by bus and 12 learners who travel by taxi, then we say we have a ratio of 8 learners travelling by bus to 12 learners travelling by taxi.

We can write this as 8 : 12. We can also simplify this ratio to 2 : 3, by dividing both parts by 4.

It is important in which order you state the ratio. A ratio of 1 : 7 is not the same as a ratio of 7 : 1.

NOTE:
Ratios don't have measurement units, because the units cancel out. So we write a ratio of 3 litres to 4 litres as 3 : 4, without writing 'litres'. The units only cancel out if they are the same, though! For example, a ratio of 300 ml to 1 litre must always be written as 300 : 1000 before we can simplify it to 3 : 10.

Writing ratios in the simplest form and equal ratios

You can write a ratio in its simplest form in the same way as you would write a fraction in its simplest form. Check if there is a number that divides into both numbers, starting with the smallest number in the ratio, and then checking with 2; 3; 5; etc. If there is none, then the ratio is already in its simplest form.

To check if ratios are equivalent write both of them in their simplest form, which will be exactly the same if they are equal. For example 5 : 10 and 30 : 60 are equivalent ratios because they both simplify to 1 : 2.

Worked example 13: Writing ratios in the simplest form

QUESTION

Write these ratios in their simplest forms:

1. 5 : 30
2. 14 : 18
3. 18 : 30
4. 7 : 280

SOLUTION

1. 5 and 30 are both divisible by 5. So the ratio simplifies to 1 : 6.
2. 14 and 18 are both divisible by 2. So the ratio simplifies to 7 : 9.
3. 18 and 30 are both divisible by 3. So the ratio simplifies to 6 : 10. However, these two numbers can both be divided by 2. So it simplifies further to 3 : 5.
4. 7 and 280 are both divisible by 7. So the ratio simplifies to 1 : 40.

Writing ratios in unit form

Writing a ratio in the simplest form will sometimes result in one of the numbers being equal to 1. This is called a unit ratio. For example, the ratio of 5 lillies to 15 daisies in a bunch of flowers is simplified to 1 : 3.

In some situations a unit ratio is not in the simplest form, for example, 5 : 9 can be written as 1 : 1,8, which is a unit ratio, but not in the simplest form. To calculate the unit form, we simply divide both numbers by the smaller number, so $5 \div 5 : 9 \div 5 = 1 : 1{,}8$.

Let's look at some situations in which the unit ratio is useful.

Worked example 14: Writing ratios in the unit form

QUESTION

1. There are 23 nurses in a hospital and 7567 patients. How many patients does each nurse have to care for?

2. In a Grade 10 class, learners are voting for a class badge. 4 learners vote for badge A and 17 vote for badge B. How many learners vote for badge B for each learner voting for badge A?

SOLUTION

1. 23 : 7567.
   Divide both numbers by 23:
   $23 \div 23 : 7567 \div 23 = 1 : 329$
   So each nurse has 329 patients to care for on average.

2. 4 : 17.
   Divide both numbers by 4.
   $4 \div 4 : 17 \div 4 = 1 : 4{,}25$
   So there are 4,25 votes for Badge B for every one vote for Badge A.

Activity 1 – 10: Working with ratios

1. Which of these pairs of ratios are equal?

   a) 3 : 4 and 75 : 10
   b) 2 : 3 and 10 : 20
   c) 5 : 1 and 100 : 20
   d) 10 : 1 and 40 : 5

2. The ratio of female learners to male learners in a class is 3 : 2. If there are 30 female learners in the class, work out:

   a) the number of male learners.
   b) the total number of learners in the class.

3. A fruit and nut company has the following standards requirement: In a packet of dried fruit and nuts, there must be two hundred grams of fruit for every 50 g of nuts.

   a) Write this as a simple ratio.
   b) What will the amount of fruit be if there are 500 g of nuts?
   c) What will the amount of fruit be if there are 25 g of nuts?

4. Tshepo wants to make orange juice out of concentrated juice. The bottle says that it must be diluted 1 : 7 with water. If he wants to make 2 litres (2000 ml) of juice in total, how many millilitres of water must he mix with how much of the concentrated juice?

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1. 249H 2. 249J 3. 249K 4. 249M

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What is a rate? EMGW

A rate, like a ratio, is also a comparison between two numbers or measurements, but the two numbers in a rate have different units.

Some examples of rate include cost rates, (for example potatoes cost R 16,95 per kg or 16,95 R/kg) and speed (for example, a car travels at 60 km/h).

When we calculate rate, we divide by the second value, so we are finding the amount per one unit.

Unit rates

For example, if we want a rate for R 20 for 2 kg of flour, we write:
R 20 : 2 kg = R 10 : 1 kg = R 10/kg.
This rate is a unit rate.

Worked example 15: Calculating rates

QUESTION

1. Elias, a star athlete, runs 100 m in 15 seconds.
    a) What is his speed in metres per second?
    b) If he was able to keep running at this speed, how long would he take to cover 1 km?
2. Cheese costs R 56 per kg. Thandi buys 200 g of cheese. How much does she pay?

SOLUTION

1. a) 100 m $\div$ 15 sec = 6,67 m/sec

   b) 100 seconds or 1 min 40 sec

2. There are 1000 g in 1 kg. We can either reason that there are 5 $\times$ 200 g in the 1000 g, and divide the cost by 5, or we can work out the cost per 100 g and then work out how much 200 g costs. The cost per 100 g would be R 5,60, so 200 g costs R 11,20.

Activity 1 – 11: Working with rates

1. A packet of 6 handmade chocolates costs R 15,95. How much does each chocolate cost?

2. A truck driver travels 1500 km in 18 hours. What is his average speed?
3. Nicola is able to input 96 words in 2 minutes on her laptop. Karen times her own typing speed as 314 words in 7 minutes. Work out their speeds to see who is faster.

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1. 249N 2. 249P 3. 249Q

Finding missing numbers in ratios and rates   EMGX

Solving problems often involves using ratios and rates to find unknown values. We use a similar process to find missing numbers in ratios and rates.

Worked example 16: Finding missing numbers in a ratio

QUESTION

Thenji makes a fruit salad for breakfast at a restaurant. She uses pieces of fruit in the following ratio:

banana : apple : paw-paw

1 : 2 : 3

1. If she uses 20 pieces of apple, how many pieces of banana and paw-paw should she use?
2. If she uses 12 pieces of banana, how many pieces of apple and paw-paw should she use?

SOLUTION

1. Let's start with the banana : apple ratio.
   1 : 2 = banana pieces : apple pieces
   1 : 2 = 10 : 20
   So we have 10 banana pieces and 20 apple pieces.
   Next we look at the apple : paw-paw ratio.
   2 : 3 = apple pieces : paw-paw pieces.
   2 : 3 = 20 : 30
   So we have 20 apple pieces and 30 paw-paw pieces.
   So the complete ratio will be 10 : 20 : 30.

2. Let's start with the banana : apple ratio.
   1 : 2 = banana pieces : apple pieces.
   1 : 2 = 12 : 24
   So we have 12 banana pieces and 24 apple pieces.
   Next, we look at the apple : paw-paw ratio.
   2 : 3 = apple : paw-paw.
   2 : 3 = 24 apple pieces : ? paw-paw pieces.
   Write in fraction form: $\frac{2}{3} = \frac{24}{\text{paw-paw}}$
   One way of solving this is to cross-multiply:
   So paw-paw pieces $\times 2 = 3 \times 24$
   therefore paw-paw pieces $= 72 \div 2 = 36$ pieces
   So the complete ratio will be 12 : 24 : 36.

Direct proportion and inverse proportion EMGY

Equal ratios have a directly proportional relationship. There is another kind of proportion that we need to investigate.

- Direct proportion: as one quantity increases, the other increases OR as one quantity decreases, the other decreases.
- Inverse proportion: as one quantity decreases, the other increases OR as one quantity increases, the other decreases.

Worked example 17: Working with inverse proportion

QUESTION

The learners at a school want to hire a hall to hold a party. They can hire the use of a hall for one evening for R 3000. The learners who are going to the party need to split the cost between them.

1. Draw up a table to show the cost per learner if 30; 50; 100; 200 and 300 learners attend the party.
2. The learners decide that they can't hold the party if they need to pay more than R 25 each. What number of learners must go to the party for it to be affordable?

SOLUTION

1.

Number of learners	Cost per learner going to the party
30	100
50	60
100	30
200	15
300	10

2. R $3000 \div$ R $25 = 120$ learners. So there must be at least 120 learners going to the party.

Activity 1 – 12: Finding unknown values in ratios and rates

1. For the following problems, calculate the unknown values. The letter x indicates an unknown value.

   a) 5 hats are to 4 coats as x hats are to 24 coats.

   b) x cushions are to 2 couches as 24 cushions are to 16 couches.

   c) 1 spacecraft is to 7 astronauts as 5 spacecraft are to x astronauts.

   d) 18 calculators are to 90 calculators as x students are to 150 students.

   e) x TV's are to R 40 000 as 1 TV is to R 1000.

2. Indicate whether the following proportions are true or false:

   a) $\frac{3}{16} = \frac{12}{64}$

   b) $\frac{2}{15} = \frac{10}{75}$

   c) $\frac{1}{9} = \frac{3}{30}$

   d) $\frac{\text{6 knives}}{\text{7 forks}} = \frac{\text{12 knives}}{\text{15 forks}}$

   e) $\frac{\text{33 kilometres}}{\text{1 litre}} = \frac{\text{99 kilometres}}{\text{3 litre}}$

   f) $\frac{\text{320 metres}}{\text{5 seconds}} = \frac{\text{65 metres}}{\text{1 second}}$

   g) $\frac{\text{35 students}}{\text{70 students}} = \frac{\text{1 class}}{\text{2classes}}$

3. Write the simplified form of the rate "sixteen sentences to two paragraphs."

4. A rectangle has a fixed area of 81 square units.

   a) Complete the table to show the inverse proportion relationship between the length and the breadth of the rectangle:

length (cm)	1	3	9	27	81
breadth (cm)				3	

   b) If this rectangle is to be used as a serviette, which of the measurements are reasonable?

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1\. 249R   2. 249S   3. 249T   4. 249V

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1.7 Percentages

EMGZ

DEFINITION: *Percentage*

A number represented as a part of 100.

How to calculate a percentage of an amount EMG32

1. Write the percentage as a fraction with the denominator 100.
   For example $20\% = \frac{20}{100}$.
   OR write the percentage as a decimal fraction, for example $20\% = 0{,}2$.
2. Multiply this fraction / decimal fraction with the amount that is given.

Let's see how this works in an example.

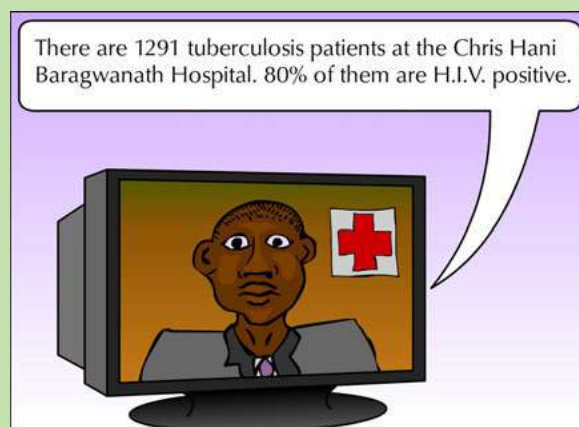
Worked example 18: Working out percentages of amounts

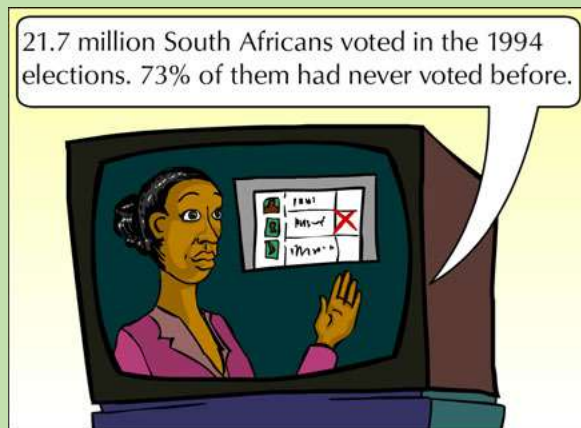
QUESTION

Use a calculator to answer the following questions:

1.

   How many people live in rural areas?

2.

   How many T.B. patients are H.I.V. positive?

3.

How many people had never voted before the 1994 election?

SOLUTION

1. $43\% = 43 \div 100$
   $\frac{43}{100} \times 50\ 586\ 757 = 21\ 752\ 305$ people live in rural areas.
   With a calculator:
   To find 43% of 50 586 757 key in:
   $43 \div 100 \times 50\ 586\ 757 =$
   OR
   $43\% \times 50\ 586\ 757 =$
2. $80\% = 80 \div 100$
   $\frac{80}{100} \times 1291 = 1032$ patients
3. $73\% = 73 \div 100$
   $\frac{73}{100} \times 21\ 700\ 000 = 15\ 841\ 000$ people had never voted before.

Worked example 19: Working out one amount as a percentage of another amount

QUESTION

Top Teenage T-shirts printed 120 T-shirts. They sold 72 T-shirts immediately. What percentage of the T-shirts were sold?

SOLUTION

72 of the 120 T-shirts were sold

$72 \div 120 \times 100 = 60\%$. So 60% of the T-shirts were sold.

Activity 1 – 13: Calculating the percentages of amounts

1. Calculate the following without a calculator:
   a) 25% of R 124,16
   b) 50% of 30 mm
2. Using your calculator and calculate:
   a) 15% of R 3500
   b) 12% of 25 litres
   c) 37,5% of 22 kg
   d) 75% of R 16,92
   e) 18% of 105 m
   f) 79% of 840 km
3. Calculate what percentage the first amount is of the second amount (you may use your calculator):
   a) 120 of 480
   b) 23 of 276
   c) 3500 ml of 5 litres
   d) 750 g of 2 kg
   e) 4 out of 5 for a test
   f) 2 out of 14 balls

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1. 249W 2. 249X 3. 249Y

Percentage discounts and increases EMG33

Look at the following extracts from newspaper articles and adverts:

DEFINITION: *Cost price*

The amount that the dealer / trader / merchant pays for an article.

DEFINITION: *Marked price*

This is the price of the article.

DEFINITION: *Selling price*

This is the price after discount.

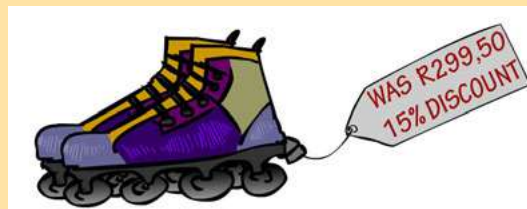
DEFINITION: *Profit*

Sale price − cost price.

Activity 1 – 14: Discounts and increases

1. The price of a tub of margarine is R 6,99. If the price rises by 10%, how much will it cost?
2. Top Teenage T-shirts have a 20% discount on all T-shirts. If one of their T-shirts originally cost R 189,90, what will you pay for it now?
3. Look at the pictures below. What is the value of each of the following items, in rands?

a)

b)

c)

d)

4. Calculate the percentage discount on each of these items:

a)

b)

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1. 249Z 2. 24B2 3. 24B3 4. 24B4

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1.8 End of chapter activity EMG34

Activity 1 – 15: End of chapter activity

1. Write the following numbers in order from biggest to smallest:

   a) 365 280; 635 765; 6 650 232; 3 695 212; 5 355 005

   b) 27,28; 1278; 872; 78,2; 7812; 28,27

   c) 8903; 893; 89,30; 89,89; 9988; 3989

   d) 12 345; 120 345; 120,54; 542 120; 55 420

2. Rewrite the following calculations with brackets to make the answers correct:

   a) $23 + 6 \times 5 = 145$

   b) $12 + 2 \times 82 = 176$

   c) $18 + 3 \times 17 = 69$

   d) $18 + 3 \times 17 = 357$

   e) $15 + 7 \times 5 = 110$

   f) $65 \times 2 + 5 = 455$

   g) $115 + 4 \times 12 = 163$

3. For each of the following questions, calculate the answer and then round it up or down depending on the situation. Explain why you rounded the way you did.

   a) Liam is packing mushrooms. There are 15 mushrooms in a punnet. He has 275 mushrooms to pack. How many punnets does he need?

   b) A car mechanic charges R 200 per hour or part thereof for labour. How much would he charge for a job that takes 270 minutes?

   c) An amusement park ride has places for 30 people. 82 people are in the queue for the ride. How many times will the ride need to run?

   d) Nokuthula is putting up washing lines in her yard. The distance from one pole to the other is 3,2 m. How many lines can she put up if she has 18 m of washing line?

4. How much would a customer pay for each of these totals in a shop?

    a) R 215,67
    b) R 329,29
    c) R 65,33

5. For each of the following problems, first write two ratios equal to each other, then find the unknown value:

    a) A recipe calls for $\frac{1}{3}$ cup sugar to 2 cups of flour. How many cups of flour do you need to add to 3 cups of sugar?
    b) A survey shows that 5 : 1 learners in a school have their own cell phone. If there are 1350 learners in the school, how many do not have their own cell phone?

6. Three litres of milk cost R 29,95 at Shop A and two litres of milk cost R 15,95 at Shop B.

    a) What is the cost per litre at each shop?
    b) Which is the better buy?
    c) How much would five litres of milk cost at each shop?

7. Two different sized jars of jam are sold at the following prices: A: 500 g for R 8,50 or B: 750 g for R 11,50. Which size is the better buy?

8. Do these calculations without a calculator:

    a) $240{,}01 \times 100$
    b) $364{,}5 \times 1000$
    c) $1865{,}03 \times 10$
    d) $990{,}13 \times 1000$
    e) $5{,}298 \times 100$
    f) $6995{,}86 \div 1000$
    g) $3784{,}41 \div 100$
    h) $788{,}1 \div 1000$

9. The following numbers are not perfect squares. Calculate the square roots of these numbers (using a calculator) and give the answer rounded off to two decimal places if necessary.

    a) 222

b) 845

c) 6120

d) 44 032

10. The price of a new car is R 210 000. Mr Simelane is offered a 12% discount. How much will he pay?

11. A packet of rice weighs 1,5 kg when it is bought. Some of the rice has been used and the packet now weighs 15% less. What is the weight of the rice that was used?

12. The price of a TV set is R 2786. If a buyer is offered an 11% discount, what does he pay for it?

13. A car was valued at R 175 000 when it was purchased. After three years it was sold for R 82 000. What percentage of its original value did the car lose?

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1. 24B5	2. 24B6	3. 24B7	4. 24B8	5. 24B9	6. 24BB
7. 24BC	8. 24BD	9. 24BF	10. 24BG	11. 24BH	12. 24BJ
13. 24BK					

NOTE:
Worked Example 1 and Activity 1 - 3 include material derived from Knight, R.; Clayton, J. Place Value and Names for Numbers, Connexions Web site. http://cnx.org/content/m26899/1.1/, Jul 3, 2009. The "Positive and negative numbers" section includes material from Ellis, W.; Burzynski, D. Signed Numbers: Signed Numbers, Connexions Web site. http://cnx.org/content/m35029/1.3/, Aug 18, 2010.

CHAPTER

Patterns, relationships and representations

2.1 Introduction and key concepts EMG35

You may well have seen diagrams in a newspaper or magazine displaying information such as how the price of petrol changes over time, or how banking fees have increased. These diagrams show us the relationship (or connection) between two things (like the price of petrol and time). They often follow particular patterns and there are, in fact, rules about how those relationships work and how they can be represented.

In this chapter, we will learn about:

- how graphs that we see around us in newspapers and magazines tell a story, which we can interpret by looking at features of the graphs.
- relationships between quantities that follow particular patterns.
- number patterns that are linear and form straight lines when we plot them on graphs
- number patterns that are inverse proportions and that form curved graphs.
- how to find rules or formulae for patterns in tables and graphs.

2.2 Making sense of graphs that tell a story EMG36

In Maths Literacy, almost every problem begins with a story, which then needs to be analysed and solved (if possible). It is easier to understand the meaning of a picture than a list of numbers. A graph is just a mathematical picture of the relationship between two quantities, such as distance and time. The advantage of a graph is that you can see and understand the whole picture at a glance.

In this section we will look at the messages that graphs give us. You will develop the skill of interpreting graphs and you will learn to identify some important features of graphs.

Graphs going up and going down (increasing and decreasing) EMG37

Worked example 1: Looking at a graph in a newspaper

QUESTION

Jabu sees the following graph in a newspaper article:

What information can Jabu extract from this graph?

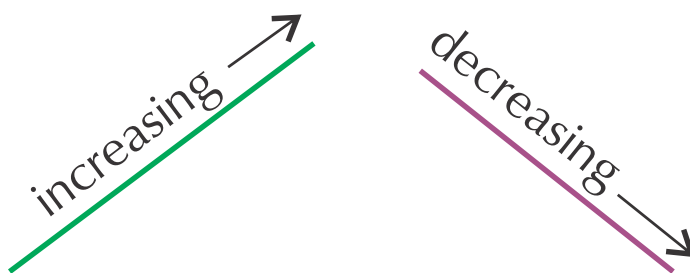
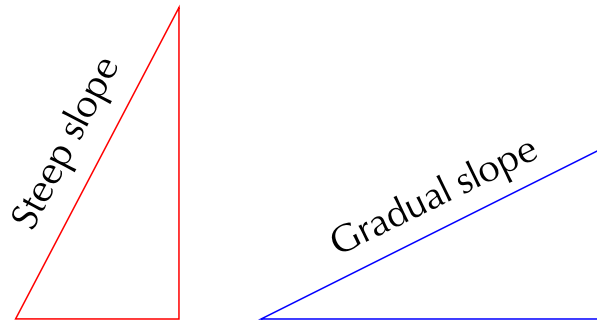
SOLUTION

- The graph shows the inflation rate for each year for seven years.
- Following the line of the graph, you can see that inflation increases (goes up) in general.
- The graph is steepest in the last year. This means that inflation increased the most during this time.

DEFINITION: *Inflation*

The increase in the price of goods in a country.

If a graph is increasing, the slope goes up from left to right.

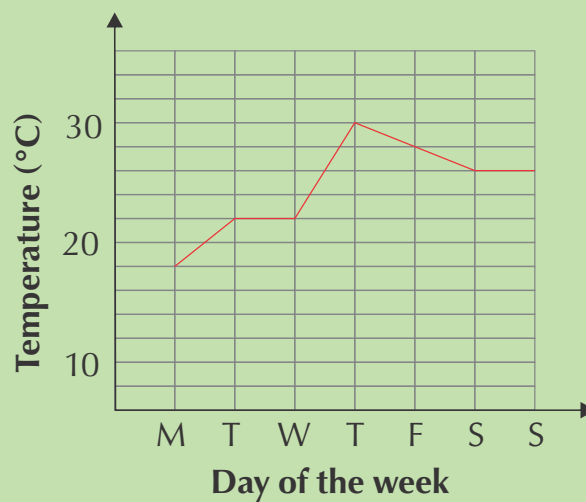
If a graph is decreasing, the slope goes down from left to right.

How do we know when a line is steeper than another line? You can see the difference by looking at the slope or gradient:

A steeper graph shows a quicker change.

A gradual slope shows a slower change.

Figure 2.1:

Hiking up a steep slope.

Worked example 2: A graph of the maximum temperature over one week

QUESTION

Answer the following questions and explain your answers by referring to the graph:

1. On which day is the temperature the lowest during the week?

2. When is the temperature the highest?
3. On which day(s) does the temperature stay the same?
4. Between which days do you see the biggest increase in temperature?
5. Which part of the graph shows a decrease in temperature?

SOLUTION

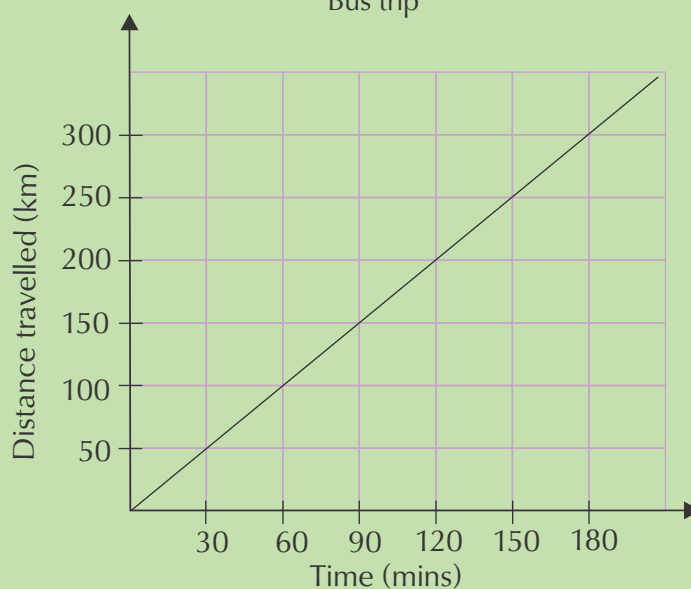
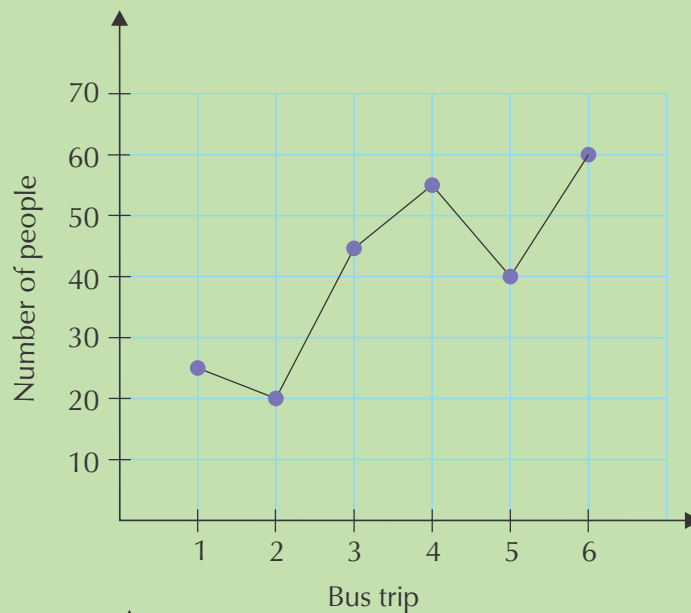
1. The graph is at the lowest point on Monday, showing that the temperature was at its lowest on Monday.
2. The highest point of the graph is on Thursday.
3. From Tuesday to Wednesday and from Saturday to Sunday, the graph is flat, showing that the temperature is constant.
4. The biggest increase in temperature takes place from Wednesday to Thursday, because the steepest part of the graph is here.
5. The graph is decreasing from Thursday to Saturday, showing a drop in temperature.

Continuous and discrete graphs EMG38

In Chapter 1 we learnt that some types of values can only be whole numbers, while others, like measurements, can have decimal fraction values. This is important when drawing graphs, because whole numbers must be shown by points on a graph, connected by dotted lines. We call these kinds of values, and graphs, **discrete**. **Continuous** values, such as length, should be connected by solid lines, to show that the values in between the points are included too.

Worked example 3: Continuous or discrete graphs

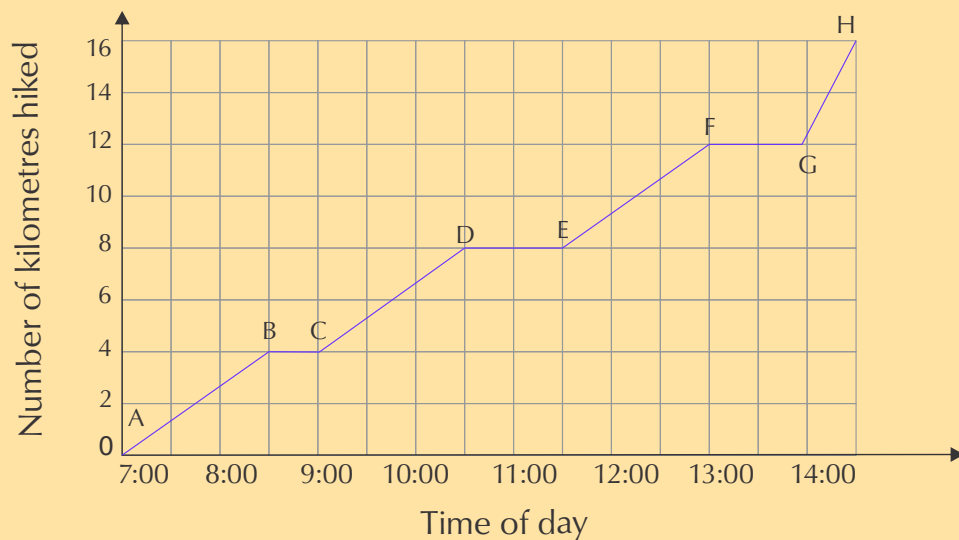
QUESTION

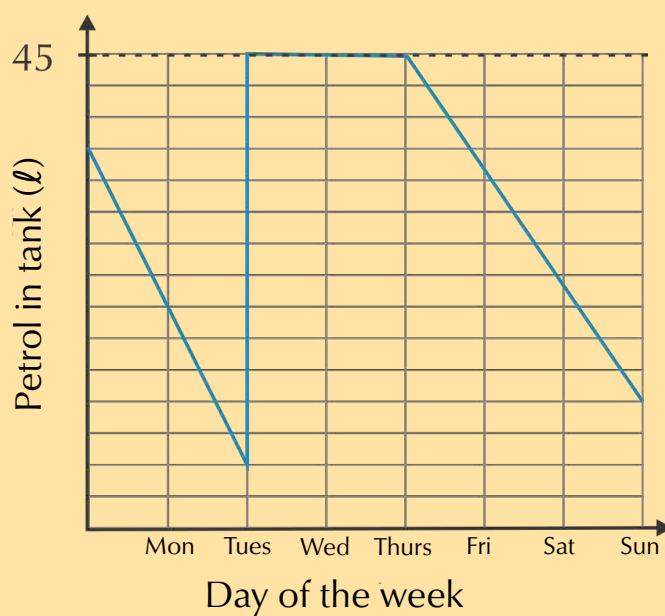
Look at the graphs on the following page. The first graph shows the number of passengers on a bus for six different trips. The second graph shows the distance that a bus travels for one trip. Explain why the first graph has dotted lines connecting the points while the second has solid lines.

SOLUTION

The first graph has discrete variables, as both the number of passengers and the number of trips can only be whole numbers (there can't be half a passenger on the bus, for example!).

The second graph shows measurement values, which are continuous. The solid line shows that all of the points along the graph are part of the relationship. Any measurement of time and distance would be valid, because the bus trip took place over a continuous number of minutes, and the bus drove all the way, along a continuous distance.

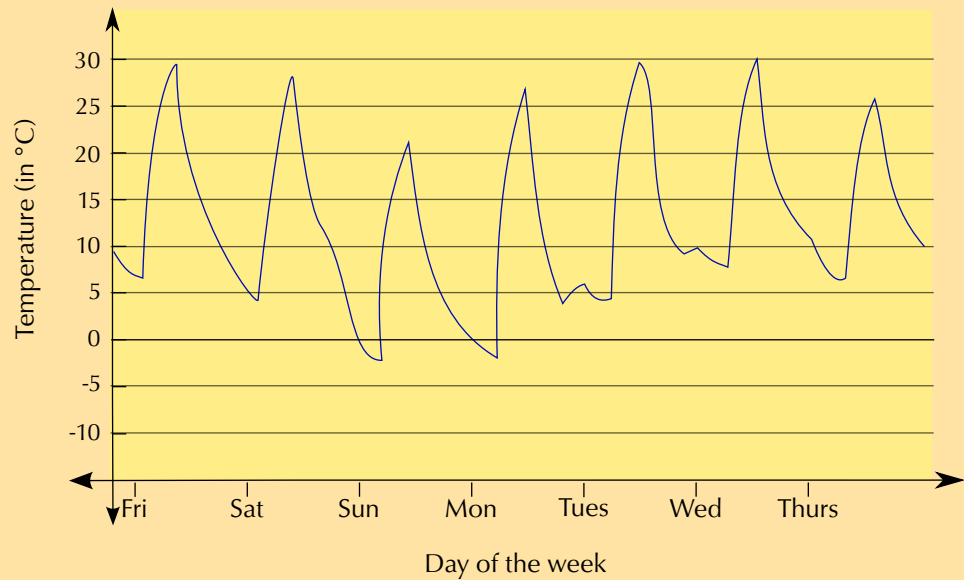
Activity 2 – 1: Interpreting graphs

1. Lindi and Thabang went on a day hike and drew this graph to show their progress.

   a) What was the total distance of the hike and how many hours did it take?
   b) Give the times when Lindi and Thabang were resting (where the distance stayed constant).
   c) One part of the graph is steeper than the others. Identify this part.

2. Pumeza's car takes 45 litres of petrol. The graph below shows the amount of petrol in the tank over one week.

   a) Is there any time when her petrol tank is completely empty? How do you know?

b) Pumeza was ill for two days during the week and stayed at home. Identify the two days and explain your answer.

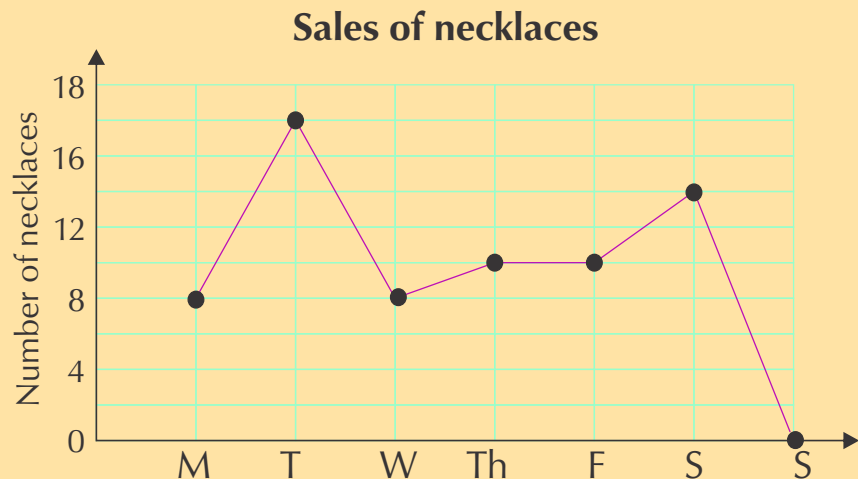
c) How many times does she fill up her car with petrol? Where do you see this on the graph?

3. The graph below shows the temperature in Bloemfontein, measured over one week in September.

a) Is this graph continuous or discrete? Explain.

b) What was the highest temperature recorded during the week? On what day was this?

c) What was the lowest temperature recorded during the week? On what day was this?

d) Write down the maximum and minimum temperatures on Wednesday. Calculate the difference between them.

4. Naledi makes and sells beaded necklaces. Look at the graph below and answer the questions:

a) Where is the highest point on the graph?

b) On which day were there no sales?
c) Between which two days is the biggest increase in sales? Explain.
d) Between which two days do the sales stay the same?
e) Describe what happens to the sales between Wednesday and Thursday.
f) Why is the graph drawn with a dotted line?

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1. 24BM 2. 24BN 3. 24BP 4. 24BQ

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Dependent and independent variables EMG39

DEFINITION: *Variable*

The quantity you are measuring or calculating.

An **independent variable** is a variable that stands alone and isn't changed by the other variables you are trying to measure. For example, someone's age might be an independent variable. Other factors (such as what they eat, how they go to school, how much television they watch) aren't going to change a person's age.

A **dependent variable** depends on other factors. For example, a test score could be a dependent variable because it could change depending on several factors such as how much you studied, how much sleep you got the night before you took the test, or even how hungry you were when you took it.

An easy way to remember which is the dependent variable and which is the independent variable is to put the names of the two variables you are using in a sentence in a way that makes the most sense. Then you can see which is the independent variable and which is the dependent variable.

For example, time causes a change in distance travelled and it isn't possible that distance travelled could cause a change in time.

When we plot graphs of variables, we usually put the independent variable on the horizontal axis and the dependent variable on the vertical axis.

Touching the axes EMG3B

What does it mean when a graph touches the horizontal axis or the vertical axis?

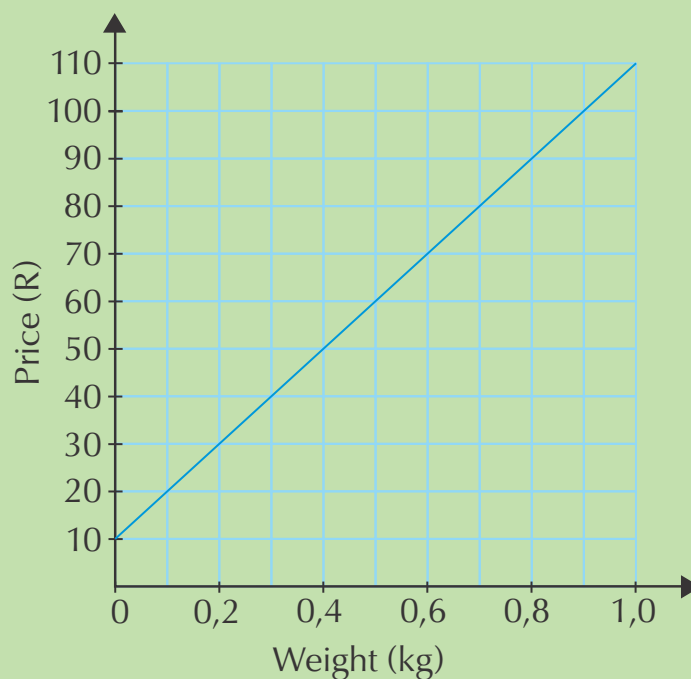
- If the graph touches the vertical or "y"-axis, it means that the quantity on the horizontal axis has reached 0.
- If a graph touches the horizontal or "x"-axis, it means that the quantity on the vertical axis has reached 0.

NOTE:
Another name for the horizontal axis is the x-axis. We plot the independent variable in a relationship on this axis. Another name for the vertical axis is the y-axis. We plot the dependent variable in a relationship on this axis.

You will not see these features on all graphs, but they are important to look for on a graph. The following worked examples show you how to interpret this in graphs.

Worked example 4: Interpreting a graph that touches the vertical axis

QUESTION

Nicola buys biltong in fancy packaging as a present for her dad. Look at this graph of the price of biltong per weight.

1. What is the price when the weight of biltong is 0 kg? Explain your answer.
2. Explain which is the independent and which is the dependent variable.

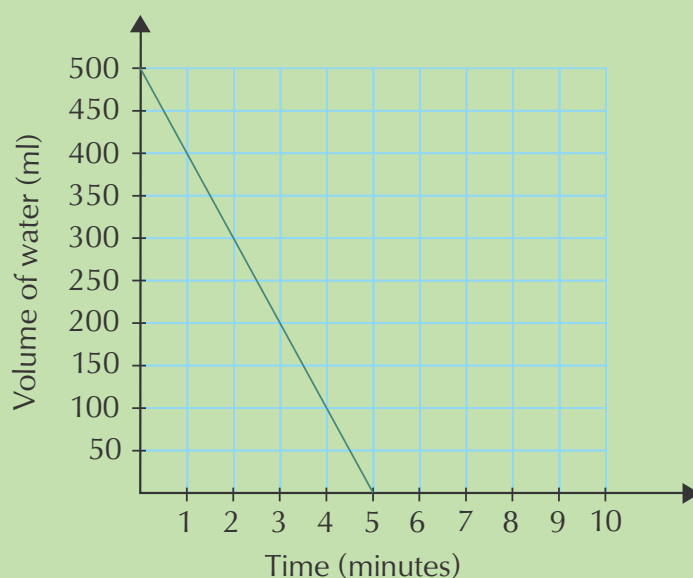
SOLUTION

1. The price of buying the biltong at 0 kg is R 10, which we read where the graph touches the vertical axis. This means that there is a starting cost of R 10, which is constant, no matter how much biltong is bought. This is probably the cost of the packaging.
2. The cost depends on the weight bought, so weight is independent and cost is dependent.

Worked example 5: Interpreting a graph that touches the horizontal axis

QUESTION

Tumelo empties his 500 ml water bottle at a constant rate.

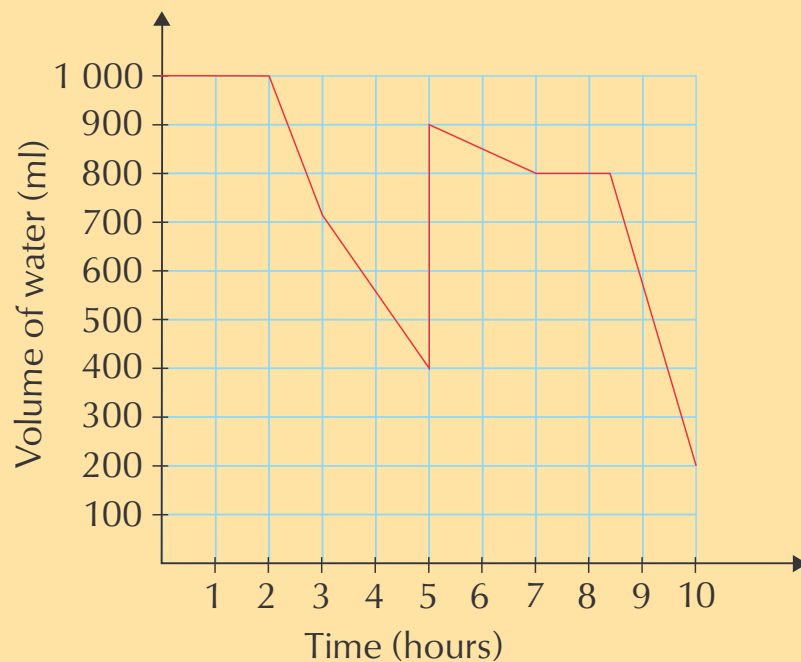
1. Describe what you see in this graph.

2. Explain which is the independent and which is the dependent variable.

SOLUTION

1. The volume starts at 500 ml, showing that the bottle is full. It decreases steadily as Tumelo empties it. At 5 minutes, it reaches 0 ml. This means it has taken 5 minutes to empty the bottle completely.
2. The volume changes with time, so time is the independent variable, and volume is dependent.

By now, you have a good idea about what kinds of things to look at when you 'read' a graph. Do the following activity to put all of this information together.

Activity 2 – 2: Reading graphs

Tumelo has a long day at work ahead and takes a one litre bottle of water to work with him. Look at this graph carefully and then answer the questions below.

1. What are the two variables plotted on this graph?
2. Which variable is dependent and which is independent? Explain fully.

3. What happens to the amount of water in the bottle during the first two hours?
4. What happens at hour number 5? Explain.
5. Between which two hours does Tumelo drink his water the fastest?
6. Does he finish all the water in his bottle at any point? How do you know this?

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1. 24BR 2. 24BS 3. 24BT 4. 24BV 5. 24BW 6. 24BX

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2.3 Linear patterns, relationships and graphs

EMG3C

We have looked at some ways in which two quantities relate to each other. and we have seen how the whole message can be shown on a graph. Two quantities often relate to each other in a way that forms a clear pattern. The next two sections deal with these patterns in table and graph form.

Plotting points on a grid EMG3D

Plotting points means that we need to plot the values of an ordered pair. An ordered pair gives us the exact position on a grid, for example: (5; 4). That the first number in an ordered pair is the horizontal coordinate and the second number is the vertical coordinate:

(horizontal; vertical)

Method:

To plot the point representing the ordered pair (5; 4):

1. Start at the origin (0; 0).

2. Move along the horizontal x-axis until you reach 5.

3. Move upwards until you are in line with 4 on the vertical y-axis.

4. Draw a dot whether the grid lines cross.

DEFINITION: *Ordered pair*

Two numbers written in a particular order so that they give the location of a point on a grid. an ordered pair is also known as a coordinate pair.

Worked example 6: Plotting points

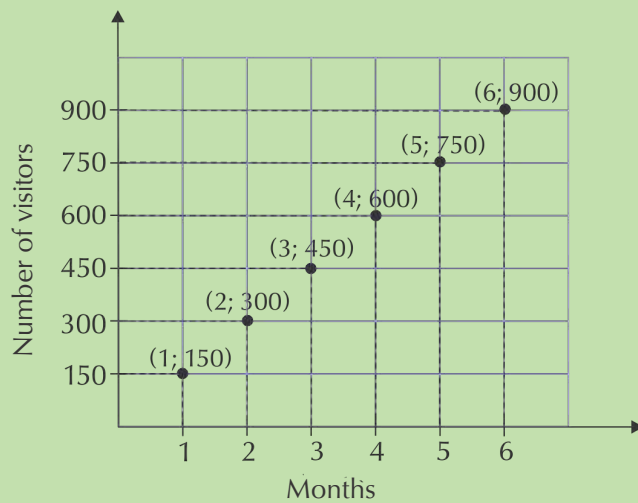
QUESTION

The number of visitors to a new museum increases by 150 visitors each month for 6 months.

Month	1	2	3	4	5	6
Number of visitors	150	300	450	600	750	900

1. Write down a set of ordered pairs for this relationship.
2. Plot the points on a graph grid.
3. Would you connect the points with a solid line? Explain.
4. Which quantity is the dependent variable, and which is the independent variable? Explain your answer.

SOLUTION

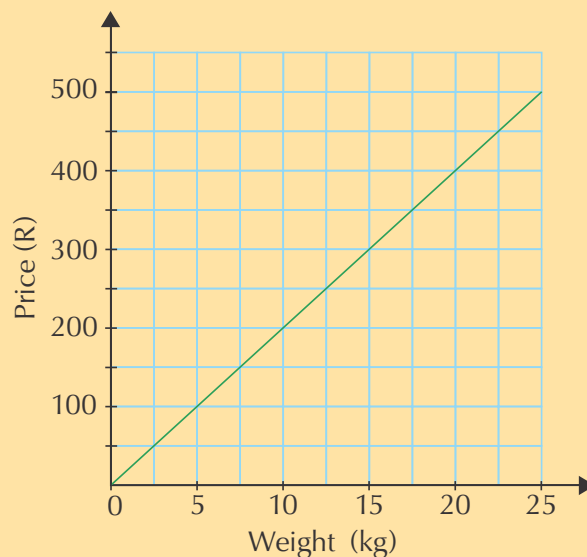
1. From the table, we get the following list of ordered pairs: (1; 150) (2; 300) (3; 450) (4; 600) (5; 750) (6; 900)
2. For each point we start at the origin, move across the horizontal x-axis to find the first number and move up the right number of spaces on the vertical y-axis to find the next number, then draw a dot to plot the point.

3. The points should not be connected by a solid line, because the values are discrete (there are no possible values in between them).
4. The month is the independent variable and the number of visitors is the dependent variable, because the number of visitors increases each month.

Linear relationships and graphs EMG3F

Some relationships between quantities give patterns that form linear graphs. How do we recognise a linear relationship?

A linear relationship forms a straight line when the points are plotted.

Activity 2 – 3: Linear relationships

1. This graph shows the cost of potatoes per weight.

a) Using the above graph, complete the table showing the same relationship:

Weight of potatoes (kg)	5	10	15	20	25	
Cost (R)	100			400		600

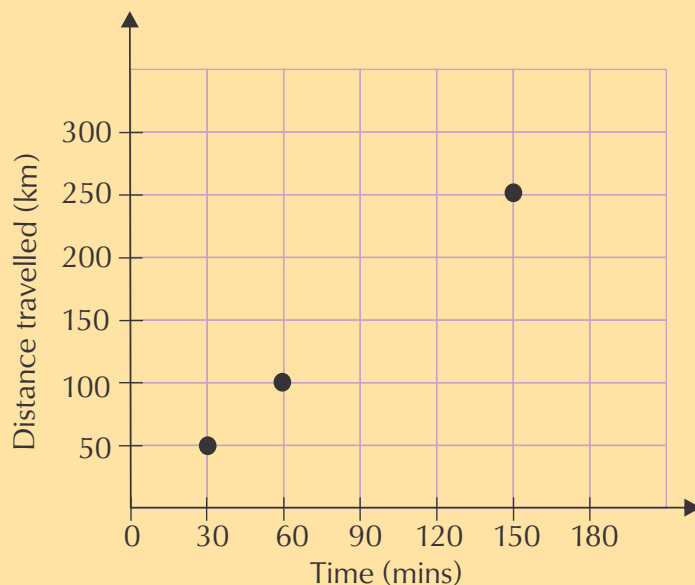
b) What will 7,5 kg of potatoes cost? Read this from the graph.

c) If you spend R 300, what is the weight of potatoes you have bought?

d) Identify the independent and dependent variables on the graph.

2. The relationship between the distance that a car travels and the time it takes is shown in the table below.

Distance travelled (km)	0	50	100	150	200	250	300
Time (minutes)	0	30	60	90	120	150	180

a) Copy and complete the graph of distance travelled against time, using the values in the table.

b) Write down the speed of the car in kilometres per hour.

3. This table shows the amount of money that a municipality charges for the amount of electricity that a household uses.

Number of units of electricity	0	100	200	300	400	500	600
Cost (cents)	0	110	220	330	440	550	660

a) Where will the graph start? Explain how you know this.

b) Plot a graph using these values.

c) Why is this graph continuous (there are no gaps between the points)?

d) We say that the cost depends on the number of units of electricity used. Explain why this is. What pattern do you see in the table?

e) Is this graph going up (increasing), going down (decreasing) or staying the same (constant)? Give a reason for your answer.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24BY 2. 24BZ 3. 24C2

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2.4 Inverse proportion patterns, relationships and graphs EMG3G

Inverse proportion relationships and graphs EMG3H

Some relationships between quantities give patterns that form inverse proportion graphs. How do we recognise an inverse proportion relationship?

Remember from Chapter 1: in an inverse proportion, as one quantity decreases, the other increases OR as one quantity increases, the other decreases.

Worked example 7: A graph of an inverse proportion

QUESTION

A rectangle has a fixed area of 32 square units, but the length l and breadth b can both change. If the length is smaller, the breadth gets bigger, because the area stays the same.

1. Complete the following table of possible values for the length and breadth of the rectangle.

length l	1	2	4	8	16	32
breadth b	32					

2. Draw a graph to show all the possible values of the length and breadth.

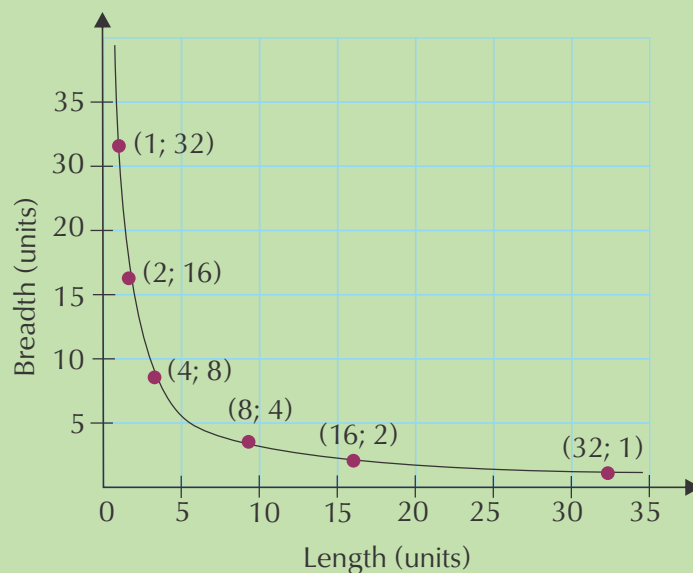
3. Is the graph continuous or discrete? Explain.

4. Why does the curve not touch the axes?

SOLUTION

1.

length l	1	2	4	8	16	32
breadth b	32	16	8	4	2	1

2.

3. The graph is continuous, because measurement values are continuous. The curve is solid and not dotted because there are an infinite number of values between the points.

4. The graph doesn't touch the axes because the length and breadth can never be 0.

The important things to note about the graph of an inverse proportion is that it is a smooth curve, and that the curve never touches the axes. In most cases, we will deal with a positive inverse proportion, because most real life values are positive. But it is possible for them to be negative too.

Activity 2 – 4: Inverse proportion patterns

1. Lerato decides to get a group of friends together to play a lucky draw game. The bigger the group, the more tickets they can buy, but if they win, they will have to share the prize among more people. The total amount of money is R 2000.

   a) If they win the prize money, how much will they have to share?

   b) How will the number in the group affect the amount each person receives?

   c) What kind of relationship is this?

   d) Copy and complete the table below including the first column which is the headings for the independent and dependent variables.

Number of people	1	2	3	4	8	10	50
Share of the prize money	2000	1000					

   e) Plot a graph of these points to show the relationship.

2. Meryl wants to make a garden bed with an area of 16 m^2.

   a) Draw up a table to show a few possible length and breadth measurements of the garden bed.

   b) Do the measurements have to be whole numbers? Explain.

   c) Draw a graph to show the relationship between the length and the breadth of the garden bed.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24C3 2. 24C4

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2.5 Finding the rule or formula EMG3J

Worked example 8: Identifying patterns

QUESTION

Elvis makes boxes of fudge and works out the cost of making the boxes by using a pattern. Look at the table below.

Number of boxes made	1	2	3	4	5	6
Cost of making the boxes (R)	6	10	14	18	22	26

1. What pattern do you see in this table?
2. Are there some different ways of describing the pattern?
3. What would it cost to make 20 boxes of fudge? How do you know?

SOLUTION

1. The cost increases by R 4 as the number of boxes increases by 1.
2. We could also say that the cost is equal to 2, plus 4 times the number of boxes. Or cost = 2 + (4 × number of boxes).
3. From our answer to Question 2, we know that the cost is equal to 2 plus 4 times the number of boxes.
   ∴ Cost = 2 + (4 × 20)
   = 2 + 80
   = 82
   So it would cost R 82 to make 20 boxes.

In the previous example we described the cost pattern using the number of boxes. This is a very useful thing to do, because it gives us a rule that we can use for any number of boxes!

The rule written in words is: cost $= 2 + (4\times$ number of boxes)

If we use variables to write the rule, we have:

$c = 2 + 4b$, where c = cost and b = number of boxes.

Notice that in the pattern in the example above, the cost of making the boxes of fudge depends on the number of boxes made. So the cost (c) is the dependent variable. The number of boxes (b) is the independent variable.

Writing a general formula EMG3K

Let's call the position of a number in a term n, so that we can use it to describe the value of the term. We call n a variable, as it can represent different values.

A general formula for any term in the sequence in the table is $(10n) - 5$.

(Remember that $10 \times n$ can also be written as $10n$.)

So for the 100th term in this sequence, $n = 100$ and the value of the term is $(10 \times 100) - 5 = 995$.

What if you wrote a different number sentence for the pattern? You might have written:

$5 + [(\mathbf{1} - 1) \times 10] = 5 + 0 = 5$

$5 + [(\mathbf{2} - 1) \times 10] = 5 + 10 = 15$

$5 + [(\mathbf{3} - 1) \times 10] = 5 + 20 = 25$

If you replace the number in bold by n, you will get

$5 + [(n - 1) \times 10]$. You will find that this simplifies as follows:

$5 + [(n - 1) \times 10]$

$= 5 + 10n - 10$

Activity 2 – 5: Describing patterns

1. Describe each of these patterns in words, and then write three more terms in each sequence:
   a) 2; 4; 8; 16;...
   b) 1; 5; 9; 13;...
   c) 3; 6; 9; 12;...
   d) 5; 10; 15; 20;...
2. Write down the first four terms of the pattern for each of the following descriptions:
   a) This number sequence starts at 1 and 20 is added each time to get the next term.
   b) This number sequence starts at 1 and each term is multiplied by 4 to get the next term.

c) This number sequence starts at 20 000 and each term is multiplied by 2 to get the next term.

3. Complete the table for the following sequence and use the information to work out the general formula and the value of the 20th term: 5; 14; 23; 32; 41; 50;. . .

Position of term (n)	1				6	20
Value of term	5	14	32	41	50	

4. Kepa sells pies at a roadside stall. He earns a basic salary of R 250 per day and a commission of 40 c on each pie he sells.

a) Write an equation for calculating how much he earns at an event.

b) Use your equation to complete the table:

Number of pies	20	40	60	80	100
Money earned (R)					

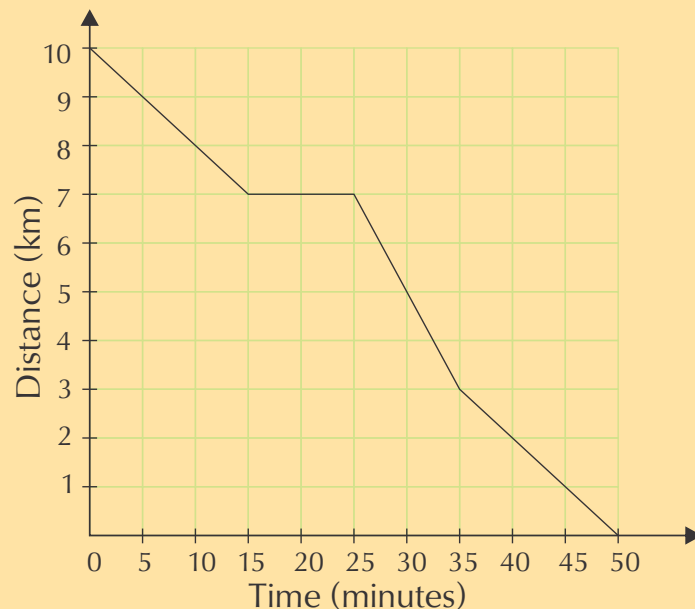
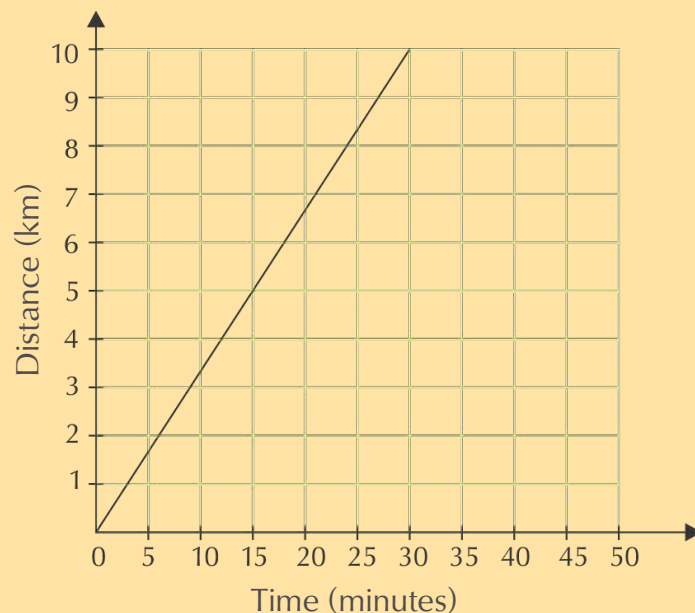
c) Plot the data points from your table and draw a graph.

d) Should Kepa use the table, the graph or the equation to work out how much money he earns at the end of the day? Explain your answer.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24C5 2. 24C6 3. 24C7 4. 24C8

Activity 2 – 6: End of chapter activity

1. The two graphs below show how Dikeledi cycled to the Post Office and back home. Compare the two graphs to answer the questions that follow.

a) What relationship is shown in each graph?

b) Explain why the first graph has a positive slope.

c) Explain why the second graph has a negative slope for most of the way.

d) How long did Dikeledi take to cycle to the Post Office?

e) What is the distance between her home and the Post Office?

f) How long did she take to cycle home from the Post Office?

g) Dikeledi 's trip home has four parts, shown by four different line segments.

i. When did Dikeledi cycle the fastest?
ii. How far did she cycle before she slowed down?
iii. When did Dikeledi cycle the slowest?
iv. How far from home was Dikeledi after 10 minutes?

2. It takes one carpenter at Jabulani Joinery 6 hours to make a wooden table. They need to make 20 wooden tables.

    a) What are the two variables in this relationship?
    b) How long would 2 carpenters take to make the table?
    c) How long would 4 carpenters take?
    d) How long would 12 carpenters take?
    e) What kind of a relationship is there between the two variables?
    f) Draw up a table of values to plot a graph of this relationship.
    g) Sketch a graph of these values.
    h) Did you use a solid line or a dotted line? Explain why.

3. A computer game shop has a special deal for regular customers. Instead of paying R 30 to hire a game, you can join the Gamers Club for R 150 per year, and pay only R 15 per DVD.

    a) How would you calculate the cost of hiring 10 games if you did not belong to the club?
    b) Write an equation for the calculation in a.
    c) How would Thomas calculate the cost of hiring five games if he belongs to the Gamers Club?
    d) Write an equation for calculating the cost of hiring any number of games for the year for Gamers Club members.
    e) In the relationship between costs and the number of games hired, which is the independent variable? Explain.
    f) Which is the dependent variable?
    g) Would a graph for this relationship have a positive or a negative slope? Give a reason for your answer.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24C9   2. 24CB   3. 24CC

CHAPTER

Conversions and time

3.1 Introduction and key concepts EMG3N

Being able to convert measurements is important for many household tasks including cooking and baking. You need to understand why and when we use different measurement units in different contexts. Understanding time and using timetables and calendars is important for personal organization, management and planning of activities (like arriving at school on time, or finishing your homework before you watch TV) and events (such as planning a party or visiting your friends).

In this chapter we will learn how to:

- convert metric units of length, volume and weight from memory.
- convert cooking units using a given table.
- read, calculate and convert different time units and formats.
- use timetables and calendars for personal planning and time management.

3.2 Converting metric units of measurement from memory EMG3P

When we measure length, volume and weight, we use various units of measurement depending on the size of what we are going to measure. Generally, the smaller the length, volume or weight of an object, the smaller the units we use. In the next sections we will look at what different units we should use and when, and how to convert between them.

Length EMG3Q

Length is a measured distance between two points. For example, the length of a book would be the distance from the bottom of the book to the top (we would measure this in centimetres). The length of a table would be the distance from one end of the table to the other end (we would measure this in centimetres or metres).

The units we use for measuring length are as follows:

km: kilometres

m: metres

cm: centimetres

mm: millimetres

Worked example 1: Deciding on units of length

QUESTION

There are four pictures below. Decide on the most appropriate unit of length for each situation.

1. The width of one of this flower's petals:

2. The length of this caterpillar:

3. The length of this wooden bench:

4. The distance between Cape Town and Johannesburg:

SOLUTION

1. The width of one of these small flower petals can be measured in millimetres (mm).
2. The length of a caterpillar can be measured in centimetres (cm).
3. The length of a wooden bench can be measured in metres (m).
4. The distance between Cape Town and Johannesburg will be measured in kilometres (km).

Figure 3.1:

The sun and the Earth, as seen from space.

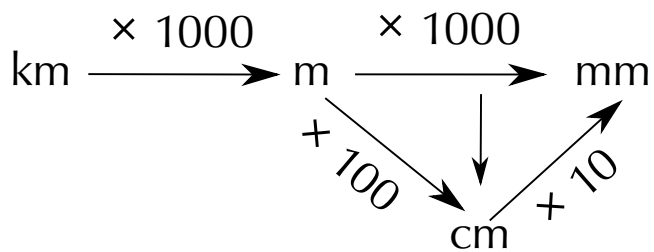
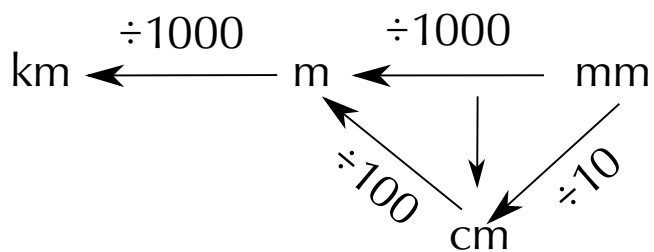
The average distance from the Earth to the Sun is approximately 150 000 000 000 metres!

Measuring distance or length using the same unit for everything can result in huge numbers with lots of zeros, which can be confusing to read. For this reason, we often convert between units to make the numbers simpler to work with.

The table below shows the relationship between the units.

Conversion factors for length
10 millimetres (mm) = 1 centimetre (cm)
1000 millimetres (mm) = 1 metre (m)
100 centimetres (cm) = 1 metre (m)
1000 metres (m) = 1 kilometre (km)

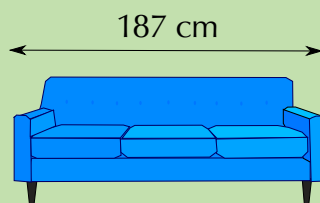
NOTE:
You will need to memorize these conversions. They will not always be given to you in an assessment.

Here is another visual representation of converting between units of length:

We can also reverse it to find lengths in larger units:

In the following worked example we will learn how to use the above conversions for units of length.

Worked example 2: Converting units of length

QUESTION

Convert the following units of length. Remember to show all of your calculations.

1. A leaf is 25 mm long. How long is it in cm?
2. A caterpillar is 3,2 cm long. What is its length in mm?
3. A sofa is 187 cm long. How long is it in metres?

4. Your school tennis court is 23,78 m long.
   a) How long is it in cm?
   b) Which unit (cm or m) do you think is best for measuring this length?
5. A vegetable garden is 1350 mm wide.
   a) How wide is it in metres (m)?

b) Which unit (mm or m) do you think is best for measuring the width of the garden?

6. The distance between Sophie's house and the shop is 6359 m. Convert this into km.
7. Reggie and Lebo live 7,02 km apart. What is this distance in metres?
8. A car drives 950 000 cm.

    a) What is this distance in km?

b) Which unit (cm or km) do you think is best for measuring the distance?

SOLUTION

1.

$$10 \text{ mm} = 1 \text{ cm}$$
$$\frac{25 \text{ mm}}{10} = 2{,}5 \text{ cm}$$

2.

$$10 \text{ mm} = 1 \text{ cm}$$
$$3{,}2 \text{ cm} \times 10 = 32 \text{ mm}$$

3.

$$100 \text{ cm} = 1 \text{ m}$$
$$\frac{187 \text{ cm}}{100} = 1{,}87 \text{ m}$$

4. a)

$$100 \text{ cm} = 1 \text{ m}$$
$$23{,}78 \text{ m} \times 100 = 2378 \text{ cm}$$

b) metres (m)

5. a)

$$1000 \text{ mm} = 1 \text{ m}$$
$$\frac{1350 \text{ mm}}{1000} = 1{,}35 \text{ m}$$

b) metres (m)

6.

$$1000 \text{ m} = 1 \text{ km}$$
$$\frac{6359 \text{ m}}{1000} = 6{,}359 \text{ km}$$

7.

$$1000 \text{ m} = 1 \text{ km}$$
$$7{,}02 \text{ km} \times 1000 = 7020 \text{ m}$$

8. a)

$$100 \text{ cm} = 1 \text{ m}$$
$$\frac{950\,000 \text{ cm}}{100} = 9500 \text{ m}$$
$$1000 \text{ m} = 1 \text{ km}$$
$$\frac{9500 \text{ m}}{1000} = 9{,}5 \text{ km}$$

b) kilometres (km)

Activity 3 – 1: Converting units of length.

1. A butterfly is 230 mm long. Convert this to cm.

2. The cover of a book is 16,2 cm long. How long is the book in mm?
3. A table is 1450 mm long. Convert this to metres.
4. A garden is 5,32 m long.

   a) How long would it be in mm?

b) Which unit (metres or millimetres) do you think is best for measuring the length of the garden?

5. A long workbench is 295 cm long. How long is it in metres?

6. A playground is 4,02 m wide.

   a) How wide is the playground in cm?

   b) Which unit (metres or centimetres) do you think is best for measuring the width of the playground?

7. Jack and Thembile live 6473 m apart. Convert this distance to km.

8. The distance between Cape Town and Betty's Bay is 90,25 km.

   a) How far is this in metres?

   b) Which unit (metres or kilometres) do you think is best for measuring this distance?

9. The distance from Phumza's house to the shop is 1 890 000 mm.

   a) How far is this in kilometres?

   b) Which unit (km or mm) do you think is best for measuring this distance?

10. Mary rides 7,82 km on her bicycle.

    a) How far does she ride in mm?

    b) Which unit (km or mm) do you think is best for measuring this distance?

11. Bongani walks 576 800 cm. How far does he walk in km?

12. Jenny runs 405 m.

    a) How far does she run, in cm?

    b) Which unit (m or cm) do you think is best for measuring how far she runs?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24CD 2. 24CF 3. 24CG 4. 24CH 5. 24CJ 6. 24CK
7. 24CM 8. 24CN 9. 24CP 10. 24CQ 11. 24CR 12. 24CS

Volume EMG3R

The volume of an object is a measure of how much space it takes up. So a tea cup will contain a certain amount, or volume, of tea (measured in millilitres), and bucket of water will contain a certain volume of water (measured in litres) and larger containers, like a dam, will contain kilolitres of water.

The capacity of an object is the maximum volume that it can hold. So, a bucket with a capacity of 10 litres can hold a maximum of 10 litres. If the bucket is only half full, the volume of water inside the bucket will be 5 litres.

The units and symbols we use for measuring volume are as follows:

kl: kilolitres

ℓ: litres

ml: millilitres

Worked example 3: Deciding on units of volume

QUESTION

There are three pictures below. Decide on the most appropriate unit of measurement for each situation.

1. The amount of coffee in this cup:

2. The amount of water in this bucket:

3. The amount of water in this water reservoir:

SOLUTION

1. The amount of coffee in this cup would be measured in millilitres (ml).
2. The amount of water in this bucket would be measured in litres (ℓ).
3. The amount of water in a water reservoir would be measured in kilolitres (kl).

Figure 3.2:

Victoria Falls in Zimbabwe

The highest recorded amount of water that went over the Victoria Falls in one second was 12 800 000 000 litres! This is a massive number and difficult to work with. As with units of length, we can convert between the various units of volume to make our calculations and measurements simpler.

The table below shows how the units relate to each other.

Conversion factors for volume
1000 millilitres (ml) = 1 litre (ℓ)
1000 litres (ℓ) = 1 kilolitre (kl)

NOTE:
You will need to know these conversions from memory. They will not always be given to you in an assessment.

Here is another visual representation of converting between units of volume:

$$\text{kl} \xrightarrow{\times 1000} \ell \xrightarrow{\times 1000} \text{ml}$$

And one can also reverse it:

$$\text{kl} \xleftarrow{\div 1000} \ell \xleftarrow{\div 1000} \text{ml}$$

Worked example 4: Converting units of volume

QUESTION

Convert the following units of volume. Remember to show all of your calculations.

1. James buys 8500 ml of paint. How much paint is this in litres?

2. Thabiso fills a bath with 23,7 ℓ of water.
   a) How much water is this in ml?
   b) Which unit (ℓ or ml) do you think is best for measuring how mcuh water is in the bath?
3. A village uses 15 600 000 ml of milk in a month. How much is this in litres?
4. The dam on Cara's farm contains 6,025 kl of water. How much is this in litres?

5. A large drum contains 0,203 kl of oil. How much is this in ml?

SOLUTION

1.

$$1000 \text{ ml} = 1\ \ell$$
$$\frac{8500 \text{ ml}}{1000} = 8{,}5\ \ell$$

2. a)

$$1000 \text{ ml} = 1\ \ell$$
$$23{,}7\ \ell \times 1000 = 23\ 700 \text{ ml}$$

b) litres (ℓ)

3.

$$1000 \text{ ml} = 1 \text{ l}$$
$$\frac{15\ 600\ 000 \text{ ml}}{1000} = 15\ 600\ \ell$$

4.

$$1000\ \ell = 1 \text{ kl}$$
$$6{,}025 \text{ kl} \times 1000 = 6025\ \ell$$

5.

$$1000\ \ell = 1 \text{ kl}$$
$$0{,}203 \text{ kl} \times 1000 = 203\ \ell$$
$$1000 \text{ ml} = 1\ \ell$$
$$203\ \ell \times 1000 = 203\ 000 \text{ ml}$$

Activity 3 – 2: Converting units of volume

1. A can of cola has a capacity of 330 ml. How many litres of cola is this?

2. A tin of paint contains 3,5 ℓ of paint. How many millilitres of paint is in the tin?
3. A reservoir on a farm holds 45 500 000 ml of water.
   a) How much water is this in ℓ?
   b) Which unit (ml or ℓ) do you think is best for measuring the capacity of the reservoir?
4. A large vat in a juice factory holds 2300 ℓ of orange juice.
   a) How many ml of orange juice can it hold?
   b) Which unit (ml or ℓ) do you think is best for measuring the capacity of the juice vat?

5. Harry's household uses 1023 ℓ of water per month. How much water do they use in kl?
6. A milk tanker truck has a capacity of 25,45 kl.
   a) How much milk can it hold in litres?
   b) Which unit do you think is best (litres or kilolitres) for measuring the capacity of the tanker truck?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24CT 2. 24CV 3. 24CW 4. 24CX 5. 24CY 6. 24CZ

Weight EMG3S

The "weight" of an object commonly refers to how heavy the object is, when weighed on a scale. The scientific word for how much an object weighs on a scale is "mass" but in this book we will use the words "weight" and "mass" interchangeably, because both are used in our everyday language.

Here are the units and symbols we use for measuring weight:

t: (metric) tonnes

kg: kilograms

g: grams

mg: milligrams

Worked example 5: Deciding on units of mass

QUESTION

There are four pictures below. Decide on the most appropriate unit of mass for each object.

1. The mass of a few grains of rice:

2. The weight of this cupcake:

3. The mass of a bag of maize:

4. The weight of this tractor:

SOLUTION

1. The mass of a few grains of rice would be measured in milligrams.
2. The weight of a cupcake would be measured in grams.
3. A big bag of maize would be measured in kilograms.
4. The weight of a tractor would be measured in tonnes.

The person standing on the above scale weighs approximately 84 000 000 milligrams.

Again, this large number is difficult to work with, and as with length and volume, we can convert between different units of weight to make our calculations simpler.

The table below shows how the units relate to each other.

Conversion factors for weight
1000 mg (mg) = 1 gram (g)
1000 grams (g) = 1 kilogram (kg)
1000 kilograms (kg) = 1 tonne (t)

NOTE:
You will need to memorize these conversions. They will not always be given to you in an assessment.

Here is another visual representation of converting between units of weight:

$$t \xrightarrow{\times 1000} kg \xrightarrow{\times 1000} g \xrightarrow{\times 1000} mg$$

And one can also reverse it:

$$t \xleftarrow{\div 1000} kg \xleftarrow{\div 1000} g \xleftarrow{\div 1000} mg$$

Worked example 6: Converting units of weight

QUESTION

Convert the following units of weight. Remember to show all of your calculations

1. A medicine tablet weighs 50 mg. How much does the tablet weigh in grams?

2. A shopping bag weighs 2850 g. how heavy is the bag in kg?
3. A book weighs 0,85 kg. Convert the weight of the book into grams.
4. A few beans weigh 34 g. How much do the beans weigh in mg?
5. An army tank weighs 65 000 kg.

a) What is the tank's weight in tonnes?

b) Which unit (kg or tonnes) do you think is best to measure the weight of the tank?

6. A truck weighs 4,025 t. What is this in kg?

7. A car weighs 1 250 000 g.

   a) Convert the weight of the car into tonnes.

   b) Which unit (grams or tonnes) do you think is best for measuring the weight of the car?

   A boulder weighs 2,35 t.

8. a) Convert the weight of the boulder into grams.

   b) Which unit (tonnes or grams) do you think is best for measuring the weight of the boulder?

SOLUTION

1.

$$1000 \text{ mg} = 1 \text{ g}$$
$$\frac{50 \text{ mg}}{1000} = 0{,}05 \text{ g}$$

2.

$$1000 \text{ g} = 1 \text{ kg}$$
$$\frac{2850 \text{ g}}{1000} = 2{,}85 \text{ g}$$

3.

$$1000 \text{ g} = 1 \text{ kg}$$
$$0{,}85 \text{ kg} \times 1000 = 850 \text{ g}$$

4.

$$1000 \text{ mg} = 1 \text{ g}$$
$$34 \text{ g} \times 1000 = 34\,000 \text{ mg}$$

5. a)

$$1000 \text{ kg} = 1 \text{ t}$$
$$\frac{65\ 000 \text{ kg}}{1000} = 65 \text{ t}$$

b) tonnes (t)

6.

$$1000 \text{ kg} = 1 \text{ t}$$
$$4{,}025 \text{ t} \times 1000 = 4025 \text{ kg}$$

7. a)

$$1000 \text{ g} = 1 \text{ kg}$$
$$\frac{1\ 250\ 000 \text{ g}}{1000} = 1250 \text{ kg}$$
$$1000 \text{ kg} = 1 \text{ t}$$
$$\frac{1250 \text{ kg}}{1000} = 1{,}25 \text{ t}$$

b) tonnes (t)

8. a)

$$1000 \text{ kg} = 1 \text{ t}$$
$$2{,}35 \text{ t} \times 1000 = 2350 \text{ kg}$$
$$1000 \text{ g} = 1 \text{ kg}$$
$$2350 \text{ kg} \times 1000 = 2\ 350\ 000 \text{ g}$$

b) tonnes (t)

Activity 3 – 3: Converting units of weight

1. A bag of maize weighs 5600 g.
   a) How much does the maize weigh in kg?
   b) Which unit (g or kg) do you think is best for measuring the weight of the bag?
2. A cooking pot weighs 2,04 kg. Convert the weight of the pot into grams.

3. A blue whale weighs 150 700 kg.

   a) How many tonnes does the whale weigh?

   b) Which unit of measurement (kilogram or tonnes) do you think is best for measuring the weight of the whale?

4. A female elephant weighs 3,126 t. How much does the elephant weigh in kg?

5. A large church bell weighs 0,852 tonnes. How much does the bell weigh in grams?

6. A bus weighs 3 500 000 g. Convert the weight of the bus into tonnes.

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1. 24D2 2. 24D3 3. 24D4 4. 24D5 5. 24D6 6. 24D7

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3.3 Converting units of measurement using given conversion factors EMG3T

Cooking conversions EMG3V

In recipes used for cooking and baking we often find the measurements for the ingredients required in cups, teaspoons and tablespoons. Measuring cups and spoons come in standard sizes, and are common in the kitchen and in recipes because they are quick and simple to use. It's very easy to measure out a quantity of baking powder in a measuring spoon, for example - much quicker than it would be weighing it on a scale.

The pictures below are examples of measuring spoons and cups. Notice that there are

half and quarter cups and spoons. This is to make it easy to accurately measure out the different quantities that are most commonly used in recipes. If you have a full set of cups (in all the different sizes), and need to measure $\frac{1}{2}$ a cup of oil, for example, you don't have to fill a whole cup half way to the top (which is an approximation, at best). You can simply use the half measuring cup and fill it to the top.

Figure 3.3:

Measuring spoons

Figure 3.4:

Measuring cups

Sometimes recipes also call for "heaped" or "rounded" teaspoons, for example. This simply means that the substance in the spoon does not have to be levelled flat, in line with the top of the spoon - there can be a bit extra "heaped" on top of the quantity in the measuring spoon.

Figure 3.5:

A heaped teaspoon of flour

Figure 3.6:

A heaped cup of flour

If you don't have measuring spoons and cups, you can use everyday household objects to approximate the same quantity of ingredients. For example, a small tea cup is roughly the same size as a measuring cup and a heaped, normal-sized spoon is about the same quantity as a measuring tablespoon. When following a recipe though, it is important to be as accurate as possible with your measurements, so using these rough approximations is often not suitable.

The quantities that measuring cups and spoons hold can be converted to volume units (like ml and ℓ) which is often useful, depending on what baking and cooking equipment you're using. For example, a recipe might call for 2 cups of mealie meal. If you don't have measuring cups but do have a measuring jug that measures ml, but know how to convert cups to ml, you can still measure out the mealie meal.

It is also useful to know how to convert between these units when you are making a larger quantity of food than a recipe is designed to produce, and you need to keep the proportions between ingredients the same.

The recipe extract below gives an example of the kinds of cooking measurements you may find:

The following table shows some of the conversions used in cooking:

Conversions for cooking and baking
1 cup = 250 ml
1 tablespoon (tbsp) = 15 ml
1 teaspoon (tsp) = 5 ml

NOTE:
you will be given these conversions in assessments.

Worked example 7: Converting units for cooking

QUESTION

Convert the following units. Remember to show all of your calculations.

1. Mbali needs 3 cups of flour to bake a cake. How many ml of flour does she need?

2. How much is 1250 ml of milk, in cups?
3. Ruth has 45 ml of sugar. How many tbsp of sugar does she have?
4. Convert 5 tbsp of oil into ml.
5. Ayanda needs to take 20 ml of cough syrup in the evening. How many teaspoons must she take?

6. Andile needs to use 6 tsp of fruit juice concentrate to make a glass of juice. How many millilitres of concentrate does he need?
7. Convert 530 ml of mealie meal into cups and tbsp.
8. Eric made 3 cups and 5 tbsp of vegetable soup for lunch. How many ml of soup does he have?

SOLUTION

1.

$$1 \text{ cup} = 250 \text{ ml}$$
$$3 \text{ cups} \times 250 \text{ ml} = 750 \text{ ml}$$

2.

$$1 \text{ cup} = 250 \text{ ml}$$
$$\frac{1250 \text{ ml}}{250} = 5 \text{ cups}$$

3.

$$1 \text{ tbsp} = 15 \text{ ml}$$
$$\frac{45 \text{ ml}}{15 \text{ ml}} = 3 \text{ tbsp}$$

4.

$$1 \text{ tbsp} = 15 \text{ ml}$$
$$5 \text{ tbsp} \times 15 \text{ ml} = 75 \text{ ml}$$

5.

$$1 \text{ tsp} = 5 \text{ ml}$$
$$\frac{20 \text{ ml}}{5} = 4 \text{ tsp}$$

6.

$$1 \text{ tsp} = 5 \text{ ml}$$
$$6 \text{ tsp} \times 5 \text{ ml} = 30 \text{ ml}$$

7. When you have to convert into two units of measurement always start by dividing with the capacity of the biggest one, in this case 250 ml:

$$1 \text{ cup} = 250 \text{ ml}$$
$$\frac{530 \text{ ml}}{250 \text{ ml}} = 2{,}12 \text{ cups}$$

Determine the remainder in ml:

$$2 \times 250 \text{ ml} = 500 \text{ ml}$$
$$530 \text{ ml} - 500 \text{ ml} = 30 \text{ ml}$$

Divide the remainder by the second (small) unit:

$$1 \text{ tbsp} = 15 \text{ ml}$$
$$\frac{30 \text{ ml}}{15 \text{ ml}} = 2 \text{ tbsp}$$

Write down the combined answer:
530 ml = 2 cups and 2 tbsp

8. Multiply each measurement by its conversion factor:

$$1 \text{ cup} = 250 \text{ ml}$$
$$\text{So } 3 \times 250 \text{ ml} = 750 \text{ ml}$$
$$1 \text{ tbsp} = 15 \text{ ml}$$
$$\text{So } 5 \times 15 \text{ ml} = 75 \text{ ml}$$

Add the answers together to determine the total:
750 ml + 75 ml = 825 ml

Activity 3 – 4: Converting units for cooking

1. Alex needs to cook 10 cups of rice. How many ml of rice must he cook?

2. A group of friends has 1500 ml of orange soda. How many cups of orange soda is this?
3. Convert 90 ml of curry powder into tablespoons.
4. What is 4 tbsp of baking powder, measured in ml?

5. A bottle contains 85 ml of medicine. How many teaspoons is this?
6. Convert 7 tsp of cooking oil into ml.
7. Convert 1060 ml of fruit juice into cups and tbsp.

8. How much is 4 cups and 6 tbsp of flour, converted into ml?

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1. 24D8 2. 24D9 3. 24DB 4. 24DC 5. 24DD 6. 24DF
7. 24DG 8. 24DH

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3.4 Reading and calculating time EMG3W

In this section we will learn how to convert between the different time formats, how to convert between different units of time and how to calculate elapsed time. Unlike units for measurement, volume and weight, units of time are not metric: the units are not multiples of 10 or 100. Rather, there are 60 seconds in 1 minute, 60 minutes in 1 hour, 24 hours in one day and so on. This means we need to be careful, particularly when converting from one unit of time to another.

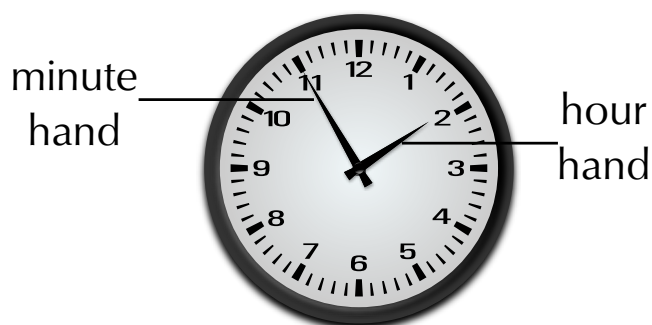
Being able to convert between different time formats and units and being able to calculate elapsed time are immensely important skills in terms of self management and planning. Time occurs in many different formats in the real world, and it is important to understand the differences and similarities of these formats. Being able to calculate how long something is going to take, or how much free time we have to do a task between two events means we can plan accordingly and organise our time and our daily lives.

Different time formats EMG3X

Time values can be expressed in different formats, such as 8 o'clock, 8:00 a.m., 8:00 p.m. and 20:00.

The two most common formats are the 12-hour format and the 24-hour format.

12-hour clock/analogue

8:00 a.m. or 8:00 p.m. are examples of readings of time using the 12-hour format. This format is seen on analogue clocks and watches. In the diagram and the pictures below, the short hand shows us the hour and the long hand shows us the minutes. Sometimes a third hand shows the seconds.

When we use the 12-hour clock, we use the letters "a.m." to show that the time is before midday (12 o'clock or noon) and "p.m." to show that it is after midday. For example, school may start at 7:30 a.m. (in the morning) and finish at 2 p.m. (in the afternoon).

NOTE:
Did you know that "a.m." stands for *ante meridiem*, which means "before noon" in Latin, and "p.m." stands for *post meridiem*, which is Latin for "after noon"?

24-hour clock/digital

20:00 is an example of the 24-hour time format. This format is seen on digital watches, clocks and on stopwatches. On digital clocks, the number on the left shows the hour and the number of the right shows the minutes. Some digital watches have a third, smaller number on the far right which shows us seconds.

The table below gives examples of 12- and 24-hour time. Look carefully at how to tell the time when it is midnight.

12-hour clock	12 a.m. (midnight)	3:00 a.m.	6:00 a.m.	9:00 a.m.	12 p.m. (midday)	3:00 p.m.	6:00 p.m.	9:00 p.m.
24-hour clock	0:00	3:00	6:00	9:00	12:00	15:00	18:00	21:00

Can you see how to convert from the 12-hour clock to the 24-hour clock?

If you compare the top line and bottom line of the table above, you will see that the times are written the same until midday. After midday, you simply **add** 12 to the the number of hours that have passed. For example: 3:00 p.m. is 3 hours after 12:00 p.m. (midday). 3 p.m. + 12 hours = 15:00. 8:30 p.m. is 8 hours 30 minutes after 12:00 p.m. 8 hours 30 minutes + 12 hours = 20:30.

To convert from the 24-hour clock to the 12-hour clock you **subtract** 12 from the number of hours. Don't forget to check whether your answer will be a.m. or p.m.! For example: 15:00 - 12 hours = 3:00. We know 15:00 is after midday, so the answer is 3:00 p.m. 20:00 - 12 hours = 8:00. 20:00 is long after midday, so the answer is 8:00 p.m.

Worked example 8: Converting between the 12-hour and 24-hour time formats

QUESTION

1. Write the following times in the 24-hour format (show all of your calculations):

    a) Jane goes to bed at 9:56 p.m.

    b) The local shop opens at 8:30 a.m.

c) Archie's cricket practice ends at 4:05 p.m.

2. Write the following times in the 12-hour format (show all of your calculations):

   a) David's school day ends at 14:45.
   b) Mrs Gwayi has morning tea at 10:25.
   c) The Dube family eat dinner at 19:35.

SOLUTION

1. a) 9:56 p.m. + 12 hours = 21:56
   b) 8:30 (This is before midday so it's written the same)
   c) 4:05 p.m. + 12 hours = 16:05
2. a) 14:45 − 12 hours = 2:45 p.m.
   b) 10:25 a.m. (This is before midday so it's written the same - we simply add the "a.m.")
   c) 19:35 − 12 hours = 7:35 p.m.

Activity 3 – 5: Converting between 12-hour and 24-hour clock times

1. Write the following times in the 12-hour format:

   a) The soccer game starts at 21:00.

   b) Elvis left the building at 17:40.
   c) Karen went to bed at 23:40.
   d) The moon rose at 00:13.

2. Write the following times in the 24-hour format:

   a) Lungile wakes up at 5:40 a.m.

b) Simphiwe ate dinner at 6:59 p.m.

c) Anna watched a movie that started at 7:18 p.m.

d) David got home from his night shift at 12:30 a.m.

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1. 24DJ 2. 24DK

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Converting units of time EMG3Y

As with all the conversions we have already done, we use different units of time to measure different events. For example, you would measure the length of your school holidays in days or weeks, not seconds. But the time it takes to walk across a road would be measured in seconds, not years!

Worked example 9: Deciding on units of time

QUESTION

There are seven pictures below. Decide on the most appropriate unit of time for each situation.

1. The time it takes for a sprinter to run 100 metres.

2. A short taxi ride.

3. The amount of time you spend at school each day.

4. The duration of a cricket test match.

5. The length of the school holidays.

6. The time it takes crops to grow.

7. Your age.

SOLUTION

1. The amount of time it takes a sprinter to run 100 m would be measured in seconds.
2. A short taxi ride would be measured in minutes.
3. The amount of time you spend at school each day is measured in hours.
4. The length of a cricket test match is measured in days.
5. The length of the school holidays can be measured in weeks.
6. The time it takes crops to grow is measured in months.
7. Your age is measured in years.

There are 86 400 seconds in a day and 604 800 seconds in a week! These are large numbers and they are not always practical to work with. We can convert between different units of time to make our calculations simpler.

The relationship between the units are given in the table below.

Conversions for time
60 seconds = 1 minute
60 minutes = 1 hour
24 hours = 1 day
7 days = 1 week
365 days = approximately 52 weeks = 12 months = 1 year

NOTE:
Most of the time we use hundreds, tens, units to do calculations. However time does not work like this. Be careful not to make mistakes when doing time calculations.

Worked example 10: Converting units of time

QUESTION

1. It takes your teacher 5 minutes to walk to your classroom. How long does it take her to walk, in seconds?
2. Learners spend 4 hours in class before second break.
   a) How many minutes do they spend in class before second break?
   b) How many seconds do they spend in class before second break?
3. The bus takes 2 days to travel from Johannesburg to Cape Town, how many hours does it take?

4. It rained for 3 weeks continuously, how many days did it rain for?

Grade 8 learners have to study for 2 years to get to Grade 10.

5. a) How many months do they have to study for?
   b) How many days do they have to study for?

6. A class of Grade 10 learners took 2 hours to complete their Maths Literacy examination, how long did the exam take them, in seconds?

7. A taxi takes 30 minutes to travel from Mowbray to Wynberg, how many hours did the journey take?

8. Amanda's mother spent 49 days in Johannesburg. How many weeks did she spend away?

9. Busi planted corn that took 6 months to grow. How many years did it take for the corn to grow?

SOLUTION

1. 1 minute = 60 seconds
   Therefore 5 minutes = 5 × 60 seconds
   = 300 seconds

2. a) 1 hour = 60 minutes
   Therefore 4 hours = 4 × 60 minutes
   = 240 minutes

b) 1 minute = 60 seconds
Therefore 240 minutes = 240 × 60 seconds
= 14 400 seconds

3. 1 day = 24 hours
Therefore 2 days = 2 × 24 hours
=48 hours

4. 1 week = 7 days
Therefore 3 weeks = 3 × 7 days
= 21 days

5. a) 1 year = 12 months
Therefore 2 years = 2 × 12 months
= 24 months

b) 1 year = 365 days
Therefore 2 years = 2 × 365 days
= 730 days

6. 1 hour = 60 minutes
Therefore 2 hours = 2 × 60 minutes
= 120 minutes
1 minute = 60 seconds
Therefore, 120 minutes = 120 × 60 seconds
= 7200 seconds

7. 1 hour = 60 minutes
Therefore 30 minutes = $\frac{30}{60}$ hours
= $\frac{1}{2}$ an hour

8. 7 days = 1 week
Therefore 49 days = $\frac{49}{7}$ weeks
= 7 weeks

9. 12 months = a year
Therefore 6 months = $\frac{6}{12}$ years
= $\frac{1}{2}$ a year

In the above exercise we looked at how to do conversions that involve two steps - such as from seconds to hours or days to months. When we do conversions like these we simply break them up into smaller parts and do one conversion at a time. So, to convert from seconds to hours, we convert seconds to minutes and then minutes to hours. To convert days to months we can convert to weeks first, and then convert weeks to months.

In some cases we can also convert directly. for example, we know that there are 365 days in a year, so to convert days to years we don't have to first convert them to weeks or months, we can take a shortcut.

So far we have worked with simple time conversions that didn't involve remainders. What happens when we want to convert a number like 80 minutes to hours though? We know that there are 60 minutes in an hour, so we might be tempted to say that 80 minutes = $\frac{80}{60}$ hours = 1,33 hours. But what does "1,33 hours" mean? It **does not** mean 1 hour and 33 minutes! We must be very careful when working with time

conversions: we cannot always use metric remainders (like 0,33 hours), because time is not metric! Instead, we have to solve for one unit (hours, minutes, seconds) at a time and carefully work out the remainders.

The following worked example will show us how to do this.

Worked example 11: Converting units of time (more complex conversions)

QUESTION

1. It takes John 140 seconds to boil water in a kettle. How many minutes and seconds does the water take to boil?

2. A movie lasts 138 minutes. How long is the movie in hours and minutes?
3. A train journey takes 34 hours. How many days and hours does the journey take?

SOLUTION

1. 60 seconds = 1 minute
   Therefore 140 seconds = $\frac{140}{60} = 2{,}33$
   This **does not** mean 2 minutes 33 seconds!
   From our answer of 2,33 we know that we have 2 whole minutes and some remainder in seconds.
   We can now work backwards to calculate the remainder:
   2 minutes = 120 seconds.
   140 seconds - 120 seconds = 20 seconds.
   So 140 seconds = 2 minutes and 20 seconds.
2. 60 minutes = 1 hour.
   Therefore 138 minutes = $\frac{138}{60} = 2{,}3$
   This **does not** mean 2 hours and 3 minutes!

We know that we have 2 whole hours and some remainder in minutes.
We now work backwards to calculate the remainder:
2 hours = 120 minutes
138 minutes - 120 minutes = 18 minutes
So 138 minutes = 2 hours and 18 minutes.

3. 24 hours = 1 day
Therefore 34 hours = $\frac{34}{24}$ = 1,417
This **does not** mean 1 day and 417 hours!
From our answer of 1,417 we know that we have 1 whole day and some remainder in hours.
We now work backwards to calculate the remainder:
1 day = 24 hours
34 hours - 24 hours = 10 hours
So 34 hours = 1 day and 10 hours

Activity 3 – 6: Converting units of time

1. A jogger runs for 40 minutes.
   a) How many hours does he run for? (Give your answer as a fraction).
   b) How many seconds does he run for?

2. A school camp last 3 days.
   a) How many hours long is the camp?
   b) How many minutes long is the camp?
   c) How many seconds long is the camp?
3. Carine goes on holiday for 6 weeks.
   a) How many days is she away for?
   b) How many hours is she away for?
4. Vusi is ill for two and a half days. For how many hours is he ill?
5. An advert on TV lasts 70 seconds. How long does the advert last, in minutes and seconds?
6. A chicken takes 100 minutes to roast in the oven. How long it does it take to roast, in hours and minutes?

7. A plane trip (with stopovers) from South Africa to China takes 38 hours. How many days and hours does the trip take?

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1. 24DM 2. 24DN 3. 24DP 4. 24DQ 5. 24DR 6. 24DS
7. 24DT

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Calculating elapsed time EMG3Z

Being able to do calculations with time is a very useful skill to have. It is important to know how to plan and organise your time on a daily basis. For example, if it takes you a certain amount of time to walk to school, what time must you leave home in the morning to arrive in time for class? Or, if you need to help cook dinner at 7pm, how much time do you have to finish your homework?

In this section we will look at how to calculate elapsed time. When doing calculations like this, we add the units of time separately, and don't forget to be careful when working with remainders!

Worked example 12: Calculating elapsed time

QUESTION

1. School starts at 07:45. You are in class for 2 hours 30 minutes. What time will the bell ring for first break? Give your answer in the 24-hour format.
2. Palesa starts cooking dinner at 6:00 p.m. She has to leave for her choir practice in 1 hour and 45 minutes.
   a) What time must she leave? (Give your answer in the 12-hour format).
   b) Convert your answer to the 24-hour format.

The bus leaves school at 14:30. It takes 70 minutes to get to Mulalo's house.

3. a) What time will he arrive at home? (Give your answer in the 24-hour format).

   b) Convert your answer to the 12-hour format.

4. Mark leaves for work at 07:45. He arrives at 08:10. How long did it take him to get there? (Give your answer in minutes).

5. Lebogang goes for a walk around her neighbourhood at 4:20 p.m. She gets back home at 5:40 p.m. How long did she walk for? (Give your answer in hours and minutes).

6. Russel finishes soccer practice at 4:00 p.m. It takes him 10 minutes to walk home. He then spends 80 minutes doing his homework.

   a) What time will Russel finish his homework? (Give your answer in the 12-hour format).

   b) Convert your answer to the 24-hour format.

Ewald's hockey practice starts at 15:10 and ends at 16:30.

7. a) How long was his hockey practice? (Give your answer in hours and minutes).

   b) If it takes him 40 minutes to get home from hockey, what time will he arrive at home? (Give your answer in the 12-hour format)

SOLUTION

1. First add the hours: 07:00 + 2 hours = 9:00
   Then add the minutes:
   45 minutes + 30 minutes = 75 minutes
   75 minutes = 60 minutes and 15 minutes = 1 hour and 15 minutes
   Calculate the total time elapsed:
   9:00 + 1 hour 15 minutes = 10:15
   So the bell will ring for break at 10:15.

2. a) First add the the hours: 6:00 p.m. + 1 hour = 7:00 pm
   Then add the minutes: 0 minutes + 45 minutes = 45 minutes
   Calculate the total time that will elapse: 7:00 p.m. and 45 minutes = 7:45 p.m.
   So Palesa must leave at 7:45 p.m.

   b) To convert this to the 24-hour time format we simply **add** 12 hours to the time:
   7:45 p.m. + 12 hours = 19:45.

3. a) First we break down 70 minutes into hours and minutes:
   We know that 60 minutes = 1 hour. 70 minutes - 60 minutes = 10 minutes, so the bus ride takes 1 hour and 10 minutes.
   Now we add the hours:
   14:30 + 1 hour = 15:30
   Next we add the minutes: 15:30 + 10 minutes = 15:40.
   So Mulalo will arrive home at 15:40

   b) To convert our answer to the 12-hour format we **subtract** 12 hours:
   15:40 - 12 hours = 3:40. We know that 15:40 is after midday, so Mulalo will arrive home at 3:40 p.m.

4. 7:45 to 8:10 is less than an hour. So in this case we only need to add the minutes it took Mark to get to work.
   7:45 + 15 minutes = 8:00
   8:00 + 10 minutes = 8:10
   10 minutes + 15 minutes = 25 minutes
   So it took Mark 25 minutes to get to work.

5. 4:20 p.m. + 1 hour = 5:20 p.m.
   5:20 p.m. + 20 minutes = 5:40 p.m.
   So Lebogang walked for 1 hour and 20 minutes.

6. a) We need to add two values to get our answer here: the time it takes Russel to walk home and the time it takes him to finish his homework.
   First we add the time it took him to walk home after soccer practice:
   4:00 p.m. + 10 minutes = 4:10 p.m.
   Next we must add the time it took him to do his homework:
   We know that 60 minutes = 1 hour.
   $\frac{80}{60} = 1{,}34$ so 80 minutes is one hour plus some remainder of minutes.
   80 minutes - 60 minutes = 20 minutes.
   So it takes Russel 1 hour and 20 minutes to do his homework.
   Now we add this to the time he got home:
   First we add the hours: 4:10 p.m. + 1 hour = 5:10 p.m.
   Then we add the minutes: 5:10 p.m. + 20 minutes = 5:30 p.m.
   So Russel finishes his homework at 5:30 p.m.

   b) To convert our answer to the 24-hour format we simply add 12 hours:
   5:30 p.m. + 12 hours = 17:30.

7. a) 15:10 + 1 hour = 16:10.
   16:10 + 20 minutes = 16:30.
   1 hour + 20 minutes = 1 hour and 20 minutes.
   So Ewald's hockey practice was 1 hour and 20 minutes long.

   b) We can divide the 40 minutes it takes Ewald to get home into 30 + 10 minutes to make it easier to add:
   16:30 + 30 minutes = 17:00

17:00 + 10 minutes = 17:10
So Ewald gets home at 17:10.
To convert this to the 12-hour format we subtract 12 hours:
17:10 - 12 hours = 5:10. We know that 17:10 is after midday so the converted time is 5:10 p.m.

Activity 3 – 7: Calculating elapsed time

1. Unathi's father goes to work at 8:00 a.m. He fetches her from school 7 hours and 30 minutes later. What time will he fetch Unathi? Give your answer in the 24-hour format.
2. Lauren finishes her music class at 15:30. It takes her 30 minutes to get home. She then does homework for 50 minutes. Lauren meets her friend 20 minutes after she finishes her homework. What time do they meet? Give your answer in the 12-hour format
3. Heather starts baking biscuits at 6:15 p.m. The biscuits must come out of the oven at 6:35 p.m. and need to cool for another 20 minutes before they can be eaten.
    a) How long will the biscuits be in the oven for?
    b) What time will they be ready to eat? (Give your answer in the 12-hour format)

4. a) Alison's favourite TV show starts at 20:35. It is forty-five minutes long. What time will it finish?
    b) If Alison watches the movie that follows her favourite show and it finishes at 10:50 p.m., how long was the movie (in hours and minutes)?
5. Vinayak is meeting his brother for lunch at 13:15. He also wants to go to the shops before lunch. It will take him 20 minutes to get from the shops to the restaurant where he's meeting his brother. If he leaves home at 10:10 how much time does he have to do his shopping? Give your answer in hours and minutes.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24DV 2. 24DW 3. 24DX 4. 24DY 5. 24DZ

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Calendars EMG42

Calendars are useful tools to help us keep track of events that are going to happen and to plan our lives accordingly. We can add information to them about important events and dates (like birthdays and school holidays) to a calendar, to help us remember what is happening when. We can read off days, weeks and months on a calendar and do conversions between these units of time.

You may have come across one more time conversion that states that 4 weeks is approximately equal to one month. This is not correct. 4 weeks is equal to 28 days, and the months of the year (except February!) have 30 or 31 days in them. When working with calendars, be careful to count the right number of days in a particular month!

Worked example 13: Using a calendar

QUESTION

Jess's calendar for the month of May is given on the next page. Study it carefully and answer the questions that follow:

MAY 2013						
MON	TUES	WED	THURS	FRI	SAT	SUN
		1 Workers' Day	2 Dad's birthday	3	4	5
6	7 Netball match	8	9	10	11	12 Mother's day
13	14	15	16	17 School camp	18 School camp	19 School camp
20	21	22 Maths Lit test	23	24	25 Granny comes to visit	26
27	28	29	30	31		

1. If it is Monday 6 May calculate how many days it is until:
    a) Mother's Day.
    b) Jess goes on her school camp.
    c) Jess's granny comes to visit.
2. If it is the 8 May:
    a) how many weeks does Jess have to study for her Maths Literacy test?
    b) How many days does she have to study for the test?
    c) How many weeks ago was her dad's birthday?
3. Will Jess go to school on 1 May? Give a reason for your answer.
4. Jess needs to buy a present for her mother for Mother's Day. If she has plans with friends on 11 May, by when should she have bought the present?
5. Jess is invited to a party on Saturday 18 May. Will she be able to attend?
6. Jess wants to bake a cake for her granny but has plans with a friend for the morning of 25 May.
    a) If her granny arrives in the evening of 25 May, when should Jess bake the cake?
    b) Given that she's busy on the morning of 25 May, when should Jess make time to buy the ingredients for the cake?

SOLUTION

1. a) 6 days
   b) 11 days
   c) 19 days
2. a) 2 weeks
   b) 14 days
   c) 0 weeks ago - it was 6 days ago.
3. No. 1 May is Workers' Day which is a public holiday.
4. Jess should buy a present for her mother by Friday 10 May.
5. No. She will be away on her school camp.
6. a) On the afternoon of Saturday 25 May.
   b) On or before Friday 24 May.

Activity 3 – 8: Creating your own calendar

1. You need to create a calendar (like the one in the previous worked example) for one month of the year. It should include the following:
   - close relatives' birthdays (that happen in that month)
   - any classmates' birthdays
   - sports fixtures
   - test and/or exam dates and times
   - school functions or events.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24F2

Timetables EMG43

Timetables are similar to calendars in that they help us plan our time. Where calendars are useful for planning months and years, timetables are useful for planning shorter periods of time like hours, days and weeks. You may already be familiar with timetables

like those for your different classes at school, and for TV shows. In this section we will learn how to read timetables and how to draw up our own.

Worked example 14: Using a timetable

QUESTION

Look at the timetable below and answer the following questions.

	SABC 1	SABC 2	SABC 3	e-TV
5:30 p.m.	Siswati/Ndebele News	News	Days of Our Lives	It's My Biz
6:00 p.m.	The Bold and the Beautiful	Leihlo La Sechaba		eNews Early Edition
6:30 p.m.	Zone'd TV	7de Laan	On The Couch	Rhythm City
7:00 p.m.	Jika Majika	Nuus	News	eNews Prime Time
7:30 p.m.	Xhosa News	American Idol	Isidingo	Scandal!
8:00 p.m.	Generations		Welcome to The Parker	Mad About You
8:30 p.m.	Shakespeare: uGugu No Andile	News		Panic Mechanic
9:00 p.m.		Muvhango		

1. What is the difference in time between the English News at 5:30 p.m. and the English News at 8:30 p.m. (both on SABC 2)?
2. How long, in minutes, is American Idol?
3. If Zonke wants to watch Isidingo after dinner at 7:30 p.m., and she needs 90 minutes to cook and eat dinner, what time should she start cooking dinner?
4. Mandla wants to watch It's My Biz and Generations. He plans to do his homework in between the two shows. If he expects each subject's homework to take 30 minutes, how many subjects worth of homework will he be able to complete between the two shows?
5. Sipho wants to watch the news in English and in Afrikaans, at the same time. Would this be possible? Give a reason for your answer.
6. Why are the blocks on the timetable for SABC 3, blank for 8:30 p.m. and 9:00 p.m.? What do the blank blocks represent?
7. What is the **total** time period allocated to the News (in all languages) across all four TV channels?

SOLUTION

1. 3 hours.
2. 7:30 to 8:30 p.m. = 1 hour = 60 minutes.
3. 90 minutes = 1 hour + 30 minutes
   7:30 p.m. - 1 hour = 6:30 p.m.
   6:30 p.m. - 30 minutes = 6:00 p.m.
4. It's My Biz finishes at 6:00 p.m. and Generations starts at 8:00 p.m. This gives Mandla 2 hours to do his homework.
   2 hours = 120 minutes.
   120 minutes ÷ 30 minutes = 4
   So Mandla will be able to do homework for four subjects in between the two shows.
5. Yes, there is the English News on SABC 3 at 7:00 p.m. and on SABC 2 there is the Afrikaans Nuus at that same time. However, he cannot watch two channels at the same time. He would need to choose a channel to watch.
6. They are blank because the program "Welcome to the Parker" is still showing.
7. There are 8 sets of news slots appearing on the timetable. Each slot is 30 minutes. Therefore, a total of 4 hours of news will be shown between 5:30 p.m. and 9:00 p.m. on four channels.

Activity 3 – 9: Writing up a timetable

1. Sipho and Mpho are brothers. Their parents require them to do household chores every day. These chores need to fit into their school sports and homework timetables.

   Using the information provided in the table below, construct a timetable for each brother for **one** day of the week.

   The two brothers' timetables need to be clearly laid out and easy to read.

SIPHO	MPHO
Soccer practice 15:30 - 16:30	Piano lesson (1 hour)
Feed the dogs	Walk the dogs for a minimum of 30 minutes
Do the dishes	Study for his Maths test: 45 minutes
Complete his Life Orientation task: 45 minutes	Set (and clear) the table before and after dinner
Watch the news at 19:00 for his history assignment	Look through the newspaper for any information on natural disasters for his geography homework.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24F3

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3.5 End of chapter activity EMG44

Activity 3 – 10: End of chapter activity

Thobeka is planning an end of term party for her classmates on a Saturday afternoon, and needs help with her measurement conversions and time management. Answer the questions that follow, and don't forget to show your working out.

1. Thobeka has a large table that she wants to use for drinks and snacks. She measures the table to be 164 cm wide.
   a) Convert the width of the table into metres.
   b) If she has a tablecloth that is 1500 mm wide, will it fit over the table? If not, by how many cm will it be too short?

c) Thobeka has chairs that are 0,4 m wide. How many chairs can she fit along one side of the table?

2. Thobeka wants to make party packets for her friends, and decides to tie them closed with pieces of ribbon. Each bag needs 100 mm of ribbon.

    a) How many centimetres of ribbon does each bag require?
    b) If Thobeka needs to tie 25 bags, how much ribbon will she need in total, in centimetres?
    c) How many metres of ribbon will Thobeka need to buy?
    d) How much will it cost?

3. Thobeka is going to buy snacks, including chips and biscuits, for her friends.

    a) Each packet of chips weighs 50 g. How much is this in kg?
    b) If each packet of chips weighs 50 g and she wants to buy 1 kg of chips in total, how many packets will she have to buy?

    c) Thobeka buys 1 kg of chips and 400 g of biscuits. What is the ratio of the weight of chips to the weight of biscuits? Write the ratio in its simplest form.
    d) Thobeka asks each of her friends to bring a bag of sweets. If each friend brings a 500 g bag and 20 friends arrive, how many kilograms of sweets will there be in total?

4. Thobeka is also planning to make orange juice using orange concentrate and water. According to the concentrate bottle, she needs to mix 1 part concentrate with 10 parts water.

    a) What is the ratio of juice to water that Thobeka needs to mix?
    b) If she uses 300 ml of concentrate, how much water must she add to dilute it? (in ml)
    c) How much juice will she have in total (concentrate + water), in litres?
    d) If each paper cup at the party can hold 200 ml, how many cups of juice will Thobeka be able to fill completely?
    e) If Thobeka mixes 400 ml of concentrate, and 4 ℓ of water, so that the total volume of juice is 4,4 ℓ of juice, what percentage of the juice is concentrate?

5. In addition to chips, biscuits and sweets Thobeka also wants to bake a cake.

    a) According to the recipe she has, Thobeka needs 4 cups of flour for one cake. If she wants to bake 3 cakes, how much flour does she need (in ml)? (1 cup = 250 ml)
    b) The recipe also calls for 25 ml of milk. How much milk does Thobeka need, in tablespoons and teaspoons? (1 tbsp = 15 ml and 1 tsp = 5 ml)
    c) Before each cake goes into the oven, Thobeka measures the amount of wet cake mixture to be 4 litres. How many cups of cake mixture is this if 1 cup = 250 ml?

6. On the invitations, Thobeka tells her friends to arrive at 2:00 p.m.

    a) She thinks she needs at least 1 hour and 20 minutes to set up the tables, chairs, food and drink. What time should she start setting up to be ready for guests?
    b) Thobeka needs to bake her cakes before she sets up. If the cakes will take 2 hours and 15 minutes (in total) to make, what time should she start baking? Write your answer in the 24-hour format.

7. Thobeka has asked her friends to bring music on CD's. She has 3 albums she wants to play that are 45 minutes, 50 minutes and 67 minutes long. If she plays her 3 albums back-to-back, how long will the music play for? Give your answer in hours and minutes.

8. Thobeka decides she needs to be organised in her party planning and wants to make a timetable, to carefully plan her day and make sure she gets everything ready in time. She has some free time the night before the party and time in the morning, on the day of the party.

    She draws up the following list and estimates how long everything will take:

    - Sweep floors (1 hour, 15 mins)
    - Set up table and chairs (15 minutes)
    - Make party packs (1 hour 40 minutes)
    - Bake cakes (45 minutes to prepare, 1 hour 30 minutes to bake in oven)

- Get dressed (10 minutes)
- Wash dishes (20 minutes)

She also really wants to watch a movie on TV the night before the party, that starts at 8:30 p.m. Bearing this in mind, and the fact that she needs 8 hours of sleep, draw up a timetable for Thobeka that includes all the things she has to do. Remember, some things she may be able to do at the same time - for example, do the dishes while the cakes are baking in the oven. Also, some things should be done before others (there is little point sweeping the floor before she bakes the cakes, because she may spill flour, for example!)

9. Thobeka has made the calendar below for the month of September. Answer the questions that follow:

Sept 2013

SUN	MON	TUES	WED	THURS	FRI	SAT
1	2	3	4	5	6	7
8	9	10	11	12 My birthday!	13	14
15	16	17 Maths Lit exam	18	19	20 End of term!	21 School holidays start!
22	23 Leave for Durban	24 Heritage Day Durban	25 Durban	26 Durban	27 Back from Durban	28
29	30					

a) i. Given that Thobeka wants her party to be an end of term celebration, what would be the best date to have it? (Remember, she wants the party to be on a Saturday).

ii. How many days after Thobeka's birthday would this be?

iii. How many days after her Maths Lit exam would it be?

b) If she changed her mind and decided she wanted the party to rather be a birthday celebration, when should she have it? (Remember, she wants to have it on a Saturday afternoon).

c) Thobeka decides to study 2 hours every day for her Maths Lit exam, and wants to study for a total of 9 hours for the exam.

i. How many days before the exam should she start her studies?

ii. How many minutes in total is she planning to study?

d) Is Thobeka likely to be directly affected by the public holiday on the 24th September? Explain your answer.

e) Thobeka is going to Durban for part of her school holidays.

   i. For how many days will she be away from home?

   ii. For how many hours will she be away from home?

f) Thobeka lives in the Northern Cape and decides to take the train to Durban. The journey will take 37 hours in total.

   i. How long will the train trip take in days and hours?

   ii. If Thobeka is planning to leave for Durban at 08:00 on Monday 23 September, on what date and at what time will she get to Durban?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24F4 2. 24F5 3. 24F6 4. 24F7 5. 24F8 6. 24F9
7. 24FB 8. 24FC 9. 24FD

CHAPTER

Financial documents and tariff systems

4.1 Introduction and key concepts EMG45

Financial documents and tariff systems often occur in the context of personal and household finance. For example, you may pay a monthly amount of money for your cellphone account, or your parents may pay a monthly amount for the electricity used by your household. You should receive a till slip with every store purchase you make and if you have a store account, you may well receive monthly accounts that you need to pay off. Understanding how these documents and systems work, and how to manage them is an important part of being able to manage your personal finances.

In this chapter we will learn about:

- financial documents relating to personal and household finance, including electricity and water bills, phone bills, till slips and account statements.
- what different items and amounts on these bills and statements represent, and how different values have been determined.
- tariff systems, including municipal tariffs for electricity, water and sewage, telephone tariffs and transport tariffs for busses, taxis and trains.
- how to calculate costs using given tariffs and to draw graphs of tariff systems, using our knowledge of graphs from Chapter 2.

4.2 Financial documents EMG46

Household bills EMG47

Household bills include municipal bills for electricity and water, telephone bills and shopping documents like till slips and account statements. You will receive a bill when you have used a service or utility (like electricity or a phone line) or made purchases using a store or credit card, which will require monthly payments on the outstanding balance. You will learn more about buying items on credit later in this chapter.

DEFINITION: *Bill*

A document detailing what items or services you have bought, how much you paid for them or the amount you still need to pay. Bills can also be called invoices or account statements, depending on what information they provide.

Some stores allow you to have a store account. You can then buy items "on your account", without having to pay cash for them at the time. You will receive an account statement once a month, detailing what you bought, what you paid into the account (called credit) and what you still owe. Municipal bills work in much the same way - you use the services before you pay for them, and receive a monthly account detailing all your usage and the associated costs.

DEFINITION: *Credit*

Money paid into an account.

DEFINITION: *Debit*

Money paid from an account.

DEFINITION: *Debt*

Money owed.

Municipal bills

Many houses in South Africa have access to electricity, water and waste disposal (rubbish removal). These utilities and services are provided by the local government (municipality) and each household has to pay a monthly amount, depending on how much electricity and water was used. In this section we will look at municipal electricity and water bills.

The City of Johannesburg provided its residents with the following example of a municipal invoice, to explain to people how to read their municipal bills. Whilst no two municipalities send out identical bills, the kind of information provided in the document is usually very similar.

Joburg
a world class African city

TAX INVOICE

(011) 375-5555
(011) 358-3408/9
PO Box 5000
Johannesburg, 2000
joburgconnect@joburg.org.za

Page 1 of 2

TAX INVOICE

Z X Deeeee
25 DEEEE AVENUE
FLORIDA
1709

Date	2011/01/07
Statement for	January 2011
Physical Address	25 DEEEE AVENUE
Stand No./Portion	00000999 - 00000
Township	FLORIDA

Stand Size	Number of Dwellings	Date of Valuation	Municipal Valuation
789 m2	1	2008/07/03	Market Value R 1,170,000.00

Invoice Number: 88000318444
Client VAT Number:
Deposit: R 570.00

Account Number: 111111111
(Pin code: 257363)

Previous Account Balance	2,138.32
Less: Incoming Payment (Last Payment Made 2010/12/30)	-2,300.00
Sub Total	-161.68
Current Charges(See Reverse for Details)	1,793.78

90 DAYS +	60 DAYS	30 DAYS	CURRENT	INSTALMENT PLAN	TOTAL AMOUNT OUTSTANDING
0.00	0.00	0.00	1,632.10	0.00	1,632.10

TOTAL DUE	R 1,632.00
DUE DATE	2011/01/28

Remittance Advice:
This stub must accompany payment, please do not detach if paying at the post office

Date: 2011/01/07 Z X Deeeee
Acc No.: 111111111 25 DEEEE AVENUE

EasyPay >>>>>>> 91115 1111111114

0146 111111111

ABSA
City of Johannesburg Bank Acc. No 405 439 8463
Branch Code 632005
Client Account No/Deposit Reference 111111111

Total Due	R 1,632.00
Due Date	2011/01/28

Figure 4.1: Joburg municipal bill, Page 1

As you can see from the above document (the first page of the bill), there are several important pieces of information included in this bill.

1. This box gives the name of the property owner and the address. This address is often the same as the address to which the services and utilities are being delivered, though in some cases people may have their bills posted to a Post Office box instead.
2. gives us information about the size and estimated value of the property. (Stand size, number of dwellings, date of valuation and municipal valuation). Basic municipal rates depend on the size of your property and often the area in which you live too. A large house (and garden) in an expensive suburb will usually pay more expensive rates than a small house in a less wealthy suburb.

3. shows us the number of this invoice. If you phone the municipality to query an invoice, they may ask you for this invoice number to find your details on their system.
4. is the account number. This is a unique number assigned to each and every person who has a municipal account. This can also be used as a reference number if you need to contact the municipality.
5. are the contact details for the municipality. You should use these if you have queries or problems with your bill.
6. shows the Value Added Tax (V.A.T) numbers of the different municipal departments that have provided services to you. In Grade 10 we don't need to work with these, it is only necessary to know that they are numbers assigned to companies and businesses for tax reasons.
7. shows the date on which the invoice was issued.
8. is a special number that you can use when paying your bill at an EasyPay pay-point. These are special machines found around the city of Joburg that allow you to pay your bill electronically.
9. are the banking details for the municipality. You will use these if you pay your bills at the bank instead of at an EasyPay pay-point.
10. shows the total amount due and the date by which it must be paid.
11. is a special code that you can use to access your account on the internet.

The second page of the bill (on the next page) looks gives the following information:

12. shows you what your basic municipal rates will cost for the month. As mentioned already, these are determined by the size, location and value of your property and house.
13. details how much you owe for electricity for the month.
14. shows how much you owe for water and sanitation (sewerage) for the month.
15. shows how much you owe for rubbish collection for the month.
16. lists any additional charges added to your bill. This section includes a Value Added Tax (VAT) charge of 14% on the total amount owed.
17. shows you the total amount of money due for all of your municipal services combined.

Account Number: 11111[illegible]		Page 2 of 2

Property Rates — VAT No.: 4760117194	Subtotal	Total Amount
Category of Property: RESIDENTIAL A		
The property rates are based on the market values of the property and		
are calculated as follows		
R 1,170,000.00 X R 0.004928 / 12 (Billing period : 2011/01)	480.48	
Less rates on first R150 000.00 of market value	-61.60	
VAT 0 %	0.00	418.88

Electricity — VAT No.: 4710191182	Subtotal	Total Amount
(Reading period = 2010/11/25 to 2010/12/[illegible] days) Actual reading obtained		
Energy meter readings and consumption: Meter no 379557 start reading 82,081.000		
and end reading 82,981.000 = 900.000 kWh		
Daily average consumption 39.130 kWh		
Charges for 900.000 kWh are based on a sliding scale for a 23 day period		
Step 1 900.000 kWh @ R 0.607400 (Billing period : 2011/01)	546.66	
Demand side management levy	18.00	
Service charge	215.54	
Network charge	58.60	
VAT: 14.00%	117.43	956.23

Water & Sanitation — VAT No.: 4270191077	Subtotal	Total Amount
Water		
(Reading period = 2010/11/25 to 2010/12/22 = 28 days) Actual reading obtained		
Meter readings and consumption: Meter no 313493 start reading 206.000		
and end reading 224.000 = 18.000 KL		
Daily average consumption 0.643 KL		
Charges for 18.000 KL are based on a sliding scale for a 28 day period		
Step 1 5.520 KL @ R 0.000000 (Billing period : 2011/01) Step 2 3.679 KL @ R 4.930000 Step 3 4.600 KL @ R 7.310000 Step 4 4.201 KL @ R 9.590000	92.06	
Sewer		
Sewer monthly charge based on Stand size 769 m2 (Billing period : 2011/01)	147.19	
VAT: 14.00%	33.50	272.75

Refuse — VAT No.: 479019292	Subtotal	Total Amount
Domestic refuse charges are based on the [illegible] the property, institutions and		
commercial charges are based on a per service charge.		
Refuse removal: 1-bin @ R 128.0000 (Billing period : 2011/01)	128.00	
VAT: 14.00%	17.92	145.92

Sundries — VAT No.: 4760117194	Subtotal	Total Amount
Miscellaneous Charge	1.00	
VAT: 14.00 %	0.14	1.14

Current Charges	1,794.82

Where can a payment be made?
Any CoJ Customer Service Centre, any Post Office, any Easy pay outlet, ABSA Bank or any other Bank (branch, ATM or internet site).
YOUR ACCOUNT NUMBER IS YOUR REFERENCE NUMBER

How to make a payment
By debit order, cash or cheque. Cheques to be made out to: " City of Johannesburg Metropolitan Municipality"
KEEP ALL RECEIPTS FOR FUTURE REFERENCE
Postdated cheques are not accepted.

How to make a payment
Payments must reach the CoJ on or before the due date

Change of address
This must be done timeously, in writing and submitted to any CoJ Customer Service Centre, or by e-mail: statements@joburg.org.za

Terminating electricity and water services
This must be done in writing 7 working days before the date you want your services terminated and submitted to any CoJ Customer Service Centre

The second page gives the full calculation of all your rebates, remissions and/ or grants.

12. Property rates will be levied on the market value of the property, no rates are levied on the first R150 000 of the market value of residential property. Owners of Sectional Title properties will directly be charged for property rates.
13. This is a detailed analysis of your electricity consumption for a specific billing period which is included in the calculation of the charges for the month. There is also a detail of the tariff applied in relation to step tariff as would be applicable to your consumption for that billing period. Step tariff is for the promotion of energy efficiency, by charging an escalating tariff as consumption increases.
14. This is a detailed analysis of your water and sanitation consumption for a specific billing period which is included in the calculation of the charges for the month. It details the billing period and the type of meter readings used for consumption, be it estimated or actual with reading date. The meter number is also reflected in this column.
15. The cost of your refuse is determined by linking the tariff to the value of your property. A city Cleaning Levy for households and businesses has been introduced to recover costs associated with this service.
16. After an account has gone through the internal collection processes and no payment is received, the account moves into the legal queues (aged 90 days and over) the account is handed over to one of the City's collections agents in an attempt to recover the outstanding monies. According to the Municipal Systems Act Section 75A, the City has the right to charge a collection fee which is indicated on the statement as a miscellaneous charge.
17. The total of the current month's consumption is reflected, with a breakdown of the services above.

Figure 4.2: Joburg municipal bill, Page 2

DEFINITION: *Value Added Tax (VAT)*

Value Added Tax is a fixed, extra cost that is added automatically to the cost of most items and services in South Africa. it is calculated as 14% of the total amount owed. We will study VAT in greater detail in Chapter 11.

Not all municipalities bundle together electricity, water and refuse charges in one account. It differs from one city to the next, but in some places you may get two separate bills - one for electricity and another for water and refuse, for example.

Also, invoices from different municipalities or companies will look different, and may use different terms to describe the same thing. You need to know a few more definitions before we move on to worked examples about municipal bills:

DEFINITION: *Opening balance*

The opening balance is the amount due on the account before the current month's expenses have been added. this often includes the balance brought forward from a previous invoice, if the last bill was not paid.

DEFINITION: *Closing balance*

The closing balance is the total amount due after all the current month's expenses have been added together. this may or may not include vat or other extra charges.

Worked example 1: Understanding a municipal invoice

QUESTION

Look at the municipal bill on the following page and answer the questions that follow:

THIS CITY WORKS FOR YOU

Civic Centre
12 Hertzog Boulevard 8001
PO Box 655 Cape Town 8000
VAT Registration number
4500193497

Tax invoice number	160003571479
Customer VAT registration number	
Account number	634812459
Distribution code	
Business partner number	1001923733

020967175023082011

MRS J. GWAYI
145 GORDON AVE
MOWBRAY
7853

Tel: 086 010 3089 - Fax: 086 010 3090
Tel: overseas clients +27 21 401 4701
E-mail: accounts@capetown.gov.za
Correspondence: Director: Revenue, P O Box 655, Cape Town 8000
Web address: www.capetown.gov.za

Account summary as at 23/08/2013 **Due date 19/09/2013**
At 145 GORDON AVE / MOWBRAY / Erf 26146

Previous account balance		2032.67
Less payments (29/07/2013) Thank you		349.67-
Arrears (a)	**Payable immediately**	**1683.00**
Latest account - see overleaf		393.72
Current amount due (b)	**Payable by 19/09/2013**	**393.72**
	Total (a) + (b)	**2076.72**
Total (a) + (b) above	2076.72	
Total liability	**2076.72**	

Electricity is expensive. Saving is simple.
For top electricity saving tips, visit www.SavingElectricity.org.za

Our dam levels are below average - save water and repair leaks.

Please note: ISUINV_20110824_014456_.prn 024882 / 024882

1. Cheques must be made payable to the City of Cape Town. Post-dated cheques will not be accepted.
2. Interest will be charged on all amounts still outstanding after the due date.
3. Failure to pay, could result in your water and/or electricity supply being disconnected/restricted. Immediate reconnection of the supply after payment cannot be guaranteed. A disconnection fee will be charged and the amount of your deposit may be increased.
4. You may not withhold payment, even if you are engaged in a dispute with the City concerning this account.
5. A convenient debit order facility is available. For further details please phone 086 010 3089.
6. Bank charges on payment amounts in excess of R4 000,00 made by credit/debit card will be debited to your account.
7. When making a direct deposit at ABSA Bank, please state your account no. 209671750.
8. Register at your bank for internet payments. Log onto your bank's website and select 'City of Cape Town Municipality' and insert your nine-digit municipal account number in the beneficiary reference field. Please ensure that there are no spaces between the numbers.

Payment: At any City of Cape Town cash office or the following:
ABSA Checkers SHOPRITE Post Office

MRS J. GWAYI

>>>>> 915552096717502

Account number	634812459
Amount due if not paid in cash	2076.72
Amount due if paid in cash	2076.70
Rounded down amount carried forward to next invoice	0.02

1. Mrs Gwayi received the above municipal invoice for electricity and refuse.
   a) What is her address (including the city that she lives in)?
   b) What is her account number?
   c) At which four stores or outlets can she pay this invoice?
   d) If Mrs Gwayi wants to query this bill, what number should she phone?
2. a) According to the bill, when last did Mrs Gwayi make a payment to the municipality?
   b) How much was her last payment?
   c) If Mrs Gwayi receives the invoice on 10 September 2013,
      i. what is the minimum amount that she needs to pay immediately?
      ii. what additional amount must she pay before 19 September?
   d) If Mrs Gwayi wants to pay her invoice in full, what is the total amount she owes?
3. Why do you think the amount due, if paying with cash, differs from the amount if not paying with cash?
4. The total amount due (total liability) includes 14% VAT but that percentage is not listed separately on this invoice. Calculate what 14% of the total amount due is (round your answer to 2 decimal places).

SOLUTION

1. a) 145 Gordon Ave, Mowbray, Cape Town, 7853
   b) 634812459
   c) Absa, Checkers, Shoprite and the Post Office
   d) 086 010 3089
2. a) 29/07/2013
   b) R 349,63
   c) i. R 1683,00
      ii. R 393,72
   d) R 2076,72
3. The total amount includes 2 cents, but we no longer use 2c coins in South Africa, so, when paying with cash, the amount is rounded down to exclude the R 0,02. Notice that the rounded down amount is not discarded - it is carried forward to the next invoice.
4. Total amount = R 2076,72
   14% of 2076,72 = $2076,72 \times \frac{14}{100}$
   = R 290,7408
   = R 290,74
   So the included VAT is R 290,74.

In South Africa we get metered electricity and pre-paid electricity.

With metered electricity, you use first and pay later. The amount of electricity you use in a month is counted by an electricity meter - a special box that may be inside your house or outside on the property, that adds up all the units of electricity you use. Once a month a meter reader from the municipality will come to the house and read your meter and make a note of how much electricity you have used. This reading then gets uploaded to the system and you receive a bill for the electricity you used in that month.

Figure 4.3:

Electricity meters outside a building

With pre-paid electricity, you pay first and use later. Much like cellphone airtime, you buy electricity vouchers (usually from your local shop) which you can then load into a special pre-paid meter at home. The pre-paid meter counts downwards, and shows you how many units worth of electricity you have left to use. No one from the municipality needs to read the meter, and you will not receive accounts because you have already paid for the electricity you have used. Pre-paid electricity is usually cheaper, per unit, than normal electricity. Buying it in advance can also make it easier to plan how much electricity you're going to use in a month, and how much you can afford to spend. However, it can be frustrating if you forget to buy a new voucher and you run out of electricity in the middle of cooking dinner!

Before you do the next worked example you need to know that electricity is measured in units called kilowatt hours (kWh), and it is charged for using set rates, or tariffs, in Rands per kWh. we shall study tariffs later in this chapter. In the meantime, you just need to understand that generally, the more electricity you use, the more expensive it becomes, per unit.

Worked example 2: Understanding an electricity account

QUESTION

Mr du Plessis gets the following account for his electricity consumption over 2 months. He has three electricity meters on his property (let's assume there are two small houses and a flat on the premises) and they are billed for together. Study his invoice and answer the questions that follow.

ESKOM HOLDINGS SOC LIMITED REG NO 2002/015527/06
VAT REG NO 4740101508

CENTRAL REGION
PO BOX 8610 JHB 2000

CONTACT CENTRE:	(0860) 037566
FAX NO:	(0866) 979065
E-MAIL:	CENTRAL@ESKOM.CO.ZA
WEB:	WWW.ESKOM.CO.ZA

TEL: 08600 37566
SMS: 082 941 3707, 083 647 1951, 084 655 5778

CUSTOMER SELF SERVICE WEBSITE: http://csonline.eskom.co.za/

DU PLESSIS, ROBERT
PO BOX 8453
PORTERVILLE
7925

YOUR ACCOUNT NO	**6392794507**
SECURITY HELD	3097.96
BILLING DATE	2012-07-12
TAX INVOICE NO	639279492961
ACCOUNT MONTH	JULY 2012
CURRENT DUE DATE	2012-08-06
VAT REG NO	NOT SUPPLIED
NOTIFIED MAX DEMAND	25.00

CENTRAL REGION
PO BOX 8610 JHB 2000

DIRECT DEPOSIT DETAIL
BANK: First National
BRANCH CODE: 255005
BANK ACC NO: 62006191077

TAX INVOICE

E-MAIL: No email address supplied

READING TYPE: ACTUAL | READING DATES: 2012/05/10 - 2012/07/10 | NO OF DAYS: 61 | SEASON:

Your next actual reading will be on 10/08/2012
CONSUMPTION SUMMARY FOR BILLING PERIOD

METER NUMBER	PREV. READING	CURR. READING	DIFFERENCE	CONSTANT	CONSUMPTION
356413	36067.0000	39086.0000	3019.0000	1.0000	3,019.0000
382471	60664.0000	63437.0000	2773.0000	1.0000	2,773.0000
382709	50248.0000	50856.0000	608.0000	1.0000	608.0000
TOTAL ENERGY CONSUMED FOR BILLING PERIOD (kWh)					6,400.00

PREMISE ID NUMBER 9161190613 **TARIFF NAME:** Homepower Standard

STAND 00145 128 OAK STREET

Energy Charge (<= 50 kWh) 85 kWh @ R0.5883 /kWh : (for 51 of 30 days)	R	50.01
Energy Charge (<= 50 kWh) 17 kWh @ R0.5733 /kWh : (for 10 of 30 days)	R	9.75
Energy Charge (> 50 kWh <= 350 kWh) 510 kWh @ R0.7309 /kWh : (for 51	R	372.76
Energy Charge (> 50 kWh <= 350 kWh) 100 kWh @ R0.7159 /kWh : (for 10	R	71.59
Energy Charge (> 350 kWh <= 600 kWh) 425 kWh @ R1.0942 /kWh : (for 51	R	465.04
Energy Charge (> 350 kWh <= 600 kWh) 83 kWh @ R1.0792 /kWh : (for 10	R	89.57
Energy Charge (> 600kWh) 4,331 kWh @ R1.2021 /kWh : (for 51 of 30 day	R	5,206.30
Energy Charge (> 600kWh) 849 kWh @ R1.1871 /kWh : (for 10 of 30 days)	R	1,007.85
Retail Environmental levy charge 5,351 kWh @ R0.02 /kWh	R	107.02
Retail Environmental levy charge 1,049 kWh @ R0.035 /kWh	R	36.72
REBILLED ADJUSTMENTS (Summary - See attachment for details)	R	-3,062.76
TOTAL CHARGES FOR BILLING PERIOD	R	4,353.85

ACCOUNT SUMMARY FOR JULY 2012

BALANCE BROUGHT FORWARD (Due Date 2012-07-14)	R	2,520.28
PAYMENT(S) RECEIVED Direct Deposit - 2012-06-27	R	-2,520.25
TOTAL CHARGES FOR BILLING PERIOD	R	4,353.85
VAT RAISED ON ITEMS AT 14%	R	609.54

ARREARS					
>90 DAYS	61-90 DAYS	31-60 DAYS	CURRENT	TOTAL AMOUNT DUE	
0.00	0.00	0.00	4,963.42	R	4,963.42

Balance brought forward is reflected in the current amount and must be paid by 2012-07-14 to avoid disconnection. Please ignore if already paid.

Message
Save electricity. If you are not using an appliance, please switch it off

PAGE RUN NO	PP 1624
BILL GROUP	
BILL PAGE	1 OF 2

ACCOUNT NO / REFERENCE NO: **6392794507**
NAME: **DU PLESSIS, ROBERT**
FAX NUMBER:

>>>>>>> 9207 2639 2794 5076
0934 6392794507

TOTAL AMOUNT DUE: 4,963.40

PAYMENT ARRANGEMENT:
INSTALMENT: 0.00
ARREARS: 0.00
DUE DATE: 2012-08-06
AMOUNT PAID:

LATE PAYMENT CHARGES WILL BE ADDED TO OVERDUE ACCOUNTS

1. a) Mr du Plessis has his electricity bill delivered to his postal (P.O. Box) address. What is the address of the property for which this electricity bill was issued?

   b) What is the total amount due?

   c) What does "billing period" mean and how long is it in this case?

   d) When last did Mr du Plessis pay his electricity account and how much did he pay?

   e) Why is the amount for "Payment(s) Received" negative (−R 2520,25)?

   f) What do you think "Balance brought forward" means?

2. The consumption levels for the first two meters listed (meter numbers 356413 and 382471) are fairly similar - they are both close to 3000 kWh. The consumption level for the third meter (number 382709) is much lower, however.

   a) Why do you think this is so?

   b) Give examples of factors that might increase a household's electricity consumption.

   The graph in the bottom left corner of the invoice shows the meter readings for Mr du Plessis' electricity consumption over the previous 12 months.

3. a) What do you think the letters under the horizontal axis mean? Is there anything unusual about their order?

   b) What does the spiky shape of the graph indicate? Give a possible reason for why the consumption (in kWh) is high for some months and at zero for others?

   c) Can you see a pattern between the high points (spikes) on the graph and the number of months that has passed? What does this pattern suggest about how often Mr du Plessis' meter is read?

SOLUTION

---

1. a) 128 Oak Street

   b) R 4963,42

   c) The billing period is a specific number of days or months covered by the invoice in question. The standard billing period is one month, in this case it is 61 days - in other words, this invoice includes electricity consumption for the 61 days before the billing date.

   d) His last payment was on 2012-06-27, for R 2520,25

   e) The amount is negative to indicate that R 2520,25 was subtracted from what Mr du Plessis owed. (This payment is called a credit - it is money being paid into the account.)

   f) "Balance brought forward" is the amount of money from the previous invoice that must still be paid, or is outstanding. In this invoice, the amount still outstanding was due to be paid by 2012-07-14, and Mr du Plessis paid it in full on 2012-06-27.

2. a) If the third meter is for a small flat on the property, for example, then the consumption will be lower because there will be fewer lights and plugs.

b) One major factor that affects how much electricity people use is the weather. In winter for example, people use more lighting (because it gets dark earlier), heaters, electric blankets and appliances like tumble dryers.

3.
a) The letters under the graph stand for the months of the year. They are not in the usual order (J (January), F (February), M, A etc) but are arranged in the order of the last 12 months, starting 12 months ago and ending with the most recent month (J (July), A (August), S (September) to J (June)).

b) The large spikes indicate when the meter reading for consumption was high, and the flat segments of the graph indicate that it was at 0 kWh. It is unlikely that Mr du Plessis used no electricity in the months when the meter reading was zero - it is more likely that the meter was not read at all (for example, if no one was home when the meter reader arrived) in those months, and so consumption was entered into the system as being 0 kWh.

c) Initially, the peaks in the graph occur once every three months (July, October, January, April). Then the graph changes and there are non-zero readings for April and May; no reading for June and again a reading for July. So, from July 2011 to April 2012, the meter was read once every 3 months. Then it was read for 2 consecutive months (April and May), and then again two months later.

Activity 4 – 1: Understanding a municipal bill

Mr Mukondwa receives the municipal bill on the opposite page. Study the document and answer the questions that follow.

1. a) Name three kinds of services included in this invoice.
   b) Which service used costs the most on this invoice?
   c) Name two different ways in which this invoice can be paid.
   d) When is payment for this invoice due?
   e) What may happen if the invoice is not paid on time?
2. a) What is the total amount due?
   b) Why is this a negative number?
   c) Is there any amount brought forward from the last invoice?
3. Water consumption is typically measured in kilolitres (kl).
   a) What is the consumption level of water on this invoice?
   b) How much is this in litres?
4. Mr Mukondwa thinks that the closing balance for his electricity consumption is much higher than normal.
   a) What does this suggest?
   b) How many units of electricity were consumed in the previous month?
   c) Can Mr Mukondwa verify this in any way? Explain your answer.
   d) What should Mr Mukondwa do if he thinks the latest meter reading for his electricity is incorrect?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24FF 2. 24FG 3. 24FH 4. 24FJ

MATJHABENG
LOCAL MUNICIPALITY
708 WELKOM 9460
(See 16. Overleaf)

ACCOUNT NUMBER	10281851
DATE OF STATEMENT	28/06/2012
VALUATION VALUE	700000

PERSONAL DETAILS

Dr / Rev. / Mr / Ms	MUKONDWA, T.A.
ADDRESS	22 PANORAMA DRIVE
	JIM FOUCHE PARK WELKOM
DEPOSIT	250.00

SERVICE	DATE	OPENING BALANCE	PAYMENT	THIS MONTH	VAT	INTEREST	ADJUSTMENT	CLOSING BALANCE
	28/06	3512.62	-7463.33	1141.55	645.00	0.00	3465.53	1301.37
	28/06	1386.65	-3280.11	282.63	271.56	0.00	1661.47	322.20
	04/06	124.31	-222.16	53.34	19.44	0.00	85.88	60.81
	04/06	277.83	-497.34	79.47	37.86	0.00	192.78	90.60
rates	28/06	878.39	-1570.96	429.66	0.00	0.00	692.57	429.66
CC	04/06	599.20	-848.66	0.00	30.65	0.00	218.81	0.00
BE	04/06	382.90	-563.57	0.00	20.98	0.00	159.69	0.00
EX	00/00	0.00	-7559.43	0.00	0.00	0.00	0.00	-7559.43
REVEST	28/06	0.00	0.00	-944.70	-132.26	0.00	0.00	-1076.96
B/ELEC	28/06	0.00	0.00	110.51	15.47	0.00	0.00	125.98
TOTALS		7161.90	-22005.56	1152.46	908.70	0.00	6476.73	AMOUNT DUE
								-6305.77

VAT REGISTRATION No. 4670194952

TAX INVOICE

ARRANGED	HANDED OVER	90 DAYS	60 DAYS	30 DAYS	CURRENT
0.00	0.00	0.00	0.00	0.00	-6305.77

Printed & Mailed by CAB Holdings

TARIFF

WATER		ELECTRICITY
0.00 - 6.00 KL	8.9900	0.8500 R/KWH
6.00 - 50.00 KL	10.8900	
50.00+ KL	14.4200	

MESSAGE

WATER METER READINGS

PREVIOUS	PRESENT	CONSUMPTION
05/02 2387.00	05/31 2414.00	27.00
CNCN996		

ELECTRICITY METER READINGS

PREVIOUS	PRESENT	CONSUMPTION
03/28 47201.00	05/24 48544.00	1343.00
19448		

PROPERTY INFORMATION

ERF No.	00006773	WARD	
STREET ADDRESS	22 PANORAMA DRIVE		
SUBURB	WELKOM - JIM FOUCHEPARK		
PORTION	0000000000000	AREA	
UNIT	0010100000677300000000000		

DISCONNECTION

The supply of services may be discontinued without further notice if any amount is unpaid after the due date and the deposit may be reviewed simultaneously. Please note that the due date does not apply to any overdue balances.

Matjhabeng Municipality has Blue Drop Status – view your drinking water quality at www.dwa.gov.za/bluedrop under "My Water"

Kindly tear off and return with payment

EasyPay REMITTANCE ADVICE

>>>>>> 9 1911 0000 1028 1851 2

DUE DATE	12/07/2012
AMOUNT DUE	-6305.77
REF NO.	10281851

DIRECT DEPOSIT / ATM / INTERNET BANKING
FOR YOUR CONVENIENCE THIS ACCOUNT MAY BE PAID AT ANY BRANCH OF ABSA BANK
BRANCH NO: 632 005
A/C No: 4053 705 465
CHEQUE PAYMENTS: PLEASE ENSURE YOUR ACCOUNT No IS REFLECTED ON THE BACK OF YOUR CHEQUE

REF NO. 10281851

Telephone bills

If your household has a fixed phone line or 'landline' (like those provided by Telkom and Neotel) or you have a cellphone on a contract (not "Pay-as-you-go") you will receive monthly bills for these services that are much like the electricity and water bills we have just looked at.

It is also possible to have a prepaid landline. To use a prepaid landline, you simply buy a voucher and load the airtime onto your account, much like a prepaid cellphone account. Prepaid landlines are advantageous for people who don't have a credit record, or have a bad credit record, because you don't need a credit history or proof of employment and bank statements to have a prepaid fixed line. (A credit record shows how good you are about paying back money that you owe. If you are in debt and don't pay your bills, you will have a bad credit record.)

With phone bills for fixed lines, you are usually charged one fixed amount for rental of the phone line, and then for any calls you made. Call costs also vary depending on where you phone, as we shall see later in this chapter.

Worked example 3: Understanding a fixed telephone line bill

QUESTION

Look at the Telkom bill provided on the opposite page and answer the questions that follow:

1. How much did Mrs Tolon owe Telkom before this bill arrived?
2. How much does she owe for this invoice alone?
3. For what month is this invoice?
4. What amount must be paid immediately and why do you think this differs slightly from the opening balance?
5. What is total amount now payable?
6. What is the closing balance, and why does it differ slightly from the total amount now payable?
7. Name two options for where or how this invoice can be paid.
8. Where is Mrs Tolon's *nearest* Telkom Office?
9. What is Mrs Tolon's landline phone number? What does Telkom refer to this number as?
10. If Mrs Tolon wants to contact Telkom to query this invoice, name two pieces of information she can use as a reference.

27093/03

Telkom invoice for MRS NA TOLON 0477140418

MRS TOLON
832 BLUEGUM ST
PHUTHADITJHABA
BLUE GUM BOSCH BLOCK A
9342

This is a tax invoice

Enquiries
For account enquiries, fault reporting and to order a new product, see page 4 for contact details.

We'll need this information

Account no	259900887796
Service ref	0477140418
Invoice no	206A1017262d
Invoice date	4 Jun 2012
Due date	26 Jun 2012
Your VAT reg no	
Group no	77960
Payment code	2011
Control code	088

Your main Telkom office
PO Box 970
Durban, 4000

Summary of your account

Previous invoice	Balance brought forward	R2,372.79
Opening balance	Amount overdue	R2,372.79
This invoice		R214.44

This invoice (Jun 2012)

Rental		R155.26
Subtotal		**R155.26**
VAT	14%	R21.74
Interest		R37.44
Total *(this invoice)*		**R214.44**

Payment remittance advice

Please pay as follows:		
Previous invoice	Overdue, please pay immediately	R2,372.75
This invoice	Please pay on or before 26 Jun 2012	R214.45
Amount now payable		**R2,587.20**

Coins discontinued	Carried forward to next invoice	R0.03
Closing balance	Amount due	R2,587.23

This full page must accompany payments at a counter
Telkom SA Ltd, Reg no 1991/005476/06, VAT no 4680101146

Mail Payment slip
(See "By mail" on page 2)

Date issued	Office		Service ref	Cycle	Amount you are paying
4 Jun 2012	Bluegum Bosch		0477140418	A	R
Group no	**System no**	**Payment code**	**Control code**	**Amount payable**	
77960	9259900885	2011	088	R2,587.20	

<<<<< 9 2021 7796 2599 0088 28 >>>>>

SOLUTION

1. The opening balance or balance brought forward is R 2372,79
2. R 214,44
3. June 2012.
4. R 2372,75. This is R 0,04 less than the opening balance - the amount has been rounded down to the nearest value payable with a 5c coin, because we no longer use 2c or 1c coins in South Africa.
5. R 2587,20
6. R 2587,23. This is 3 cents more than the amount now payable. The amount now payable has also been rounded down to the nearest multiple of 5 cents.
7. Mrs Tolon can pay the invoice at a Telkom counter or by posting a cheque in the mail.
8. The Bluegum Bosch Telkom branch.
9. Her phone number is 047 714 0418. Telkom calls this the "service ref" which means "service reference"
10. She can use her phone number or her account number.

Different cellular providers in South Africa (like MTN, Vodacom, Cell C, 8ta and Virgin Mobile) offer different packages. You can have a contract with them, where you pay a monthly subscription and then pay for your calls and messages at the end of the month; or you can buy prepaid airtime upfront and then have the cost of your calls and messages deducted from that airtime.

Worked example 4: Understanding a cellphone account

QUESTION

Study the cellphone invoice on the opposite page and answer the questions that follow:

TAX INVOICE

MTN Service Provider (Pty) Limited
216 14th Avenue, Fairland, Roodepoort, 2195
Private Bag 9955, Cresta, 2118
MTN SP Reg. No.:1993/002648/07
VAT Registration No.: 4130141247

CUSTOMER CARE ENQUIRIES
Tel.: +27(0)83-1-808
Tel.: 808 (free from MTNSP cellphone)
E-mail: mtnsp@mtn.co.za
Website: www.mtnsp.co.za

Mr Rael Finlay
Mr Rael Finlay
103 The Vines
Alphen Mill Road
MAYNARDVILLE
-
7834

VAT REG. NO.:		INVOICE NO.:	E584814233
ACCOUNT NO.:	A9056652	INVOICE DATE:	20/05/2012
CELLPHONE NO.:	081 423 7012	NAME:	Mr Rael Finlay

[illegible]

Standard Services currently available on your package:

BASIC DATA AND FAX
BIS
BASIC TELEPHONY
CALLING LINE IDENTITY
MOBILE ORIGINATING SMS

[illegible]

CONFERENCE CALLING
PACKET SWITCHED DATA
ALLOW INTERNATIONAL DIALLING

Unless a query is raised in respect of the contents of this bill within 30 days from the date thereof, the contents shall be deemed to be correct.

Please note: all disputes which have not been resolved by MTNSP may be referred to the Ombudsman at info@lemao.co.za and or 083 209 2677 / 083 209 2678

DATE	TRANSACTION	AMOUNT
20/05/2012	BLACKBERRY INTERNET SERVICE HIGH	51.75
20/05/2012	BLACKBERRY SERVICE FEE DISCOUNT	-51.75
20/05/2012	CALL LINE IDENTITY MONTHLY FEE	7.02
20/05/2012	PROMO SERVICE FEE	86.84
20/05/2012	MTN 200 TopUp SUBSCRIPTION	175.44
20/05/2012	CLI MONTHLY DISCOUNT	-7.02

TOTAL EXCLUDING VAT	**262.28**
VAT AT 14.00 %	**36.72**
TOTAL	**R 299.00**

Dial *141*9# and this could be less
Join the MTN 1-4-1 Loyalty programme and you save on your monthly bill
Dial *141*9*Your ID Number# from your phone or visit www.mtn.co.za/loyalty to join for free.

CYC58008497_2_98231

LAST SIX BILLING PERIODS

11-2011	12-2011	01-2012	02-2012	03-2012	04-2012
R 398.00	R 299.00	R 299.00	R 299.00	R 299.00	R 299.00

AVERAGE SPENT	**R 315.50**

MTNSP Bank Details: ABSA Bank, Account No.: 4063304150, Branch Code: 632005
MTN SERVICE PROVIDER (PTY) LTD IS LICENCED AS A FINANCIAL SERVICE PROVIDER - Licence No: 23660

Page 1 of 1

1. Which company is the service provider?
2. What is Mr Finlay's cell phone number?
3. What kind of cellphone do you think Mr Finlay owns? Explain your answer.
4. For which service did he receive a 100% refund? Explain your answer.
5. Does Mr Finlay receive any other discounts? If so, what where they?
6. What is the most expensive item in the list of transactions? What do you think this amount is for?
7. How do we know that Mr Finlay has been an MTN client since at least November 2011?
8. Can Mr Finlay make calls to international numbers on his phone? Explain your answer.
9. How many days does he have to query this invoice?
10. MTN includes the average spent per month, over the last 6 months. Show how they calculate this average.
11. Show how MTN calculated the 14% VAT that is added to the total excluding VAT

SOLUTION

1. MTN
2. 081 423 7012
3. A Blackberry - the transaction column lists Blackberry internet services.
4. He received a full discount for his Blackberry Internet Service. We know this because the same amount that is added to his account (R 51,75) is also subtracted.
5. Mr Finlay received a R 7,02 discount for "CLI Monthly Discount"
6. The most expensive item is "MTN 200 TopUp Subscription". This is the fixed amount that Mr Finlay pays for his cellphone contract (an MTN TopUp 200 type contract) each month.
7. The invoice includes Mr Finlay's last 6 billing periods, the first of which is dated 11-2011.
8. Yes. One of the "Additional Services" listed in the grey column on the left hand side of the page is "Allow International Calling"
9. Mr Finlay has 30 days to query the invoice.
10.

$$\begin{aligned}\text{Average} &= \frac{\text{Total amount over 6 months}}{\text{Number of amounts}}\\ &= \frac{\text{R } 398+299+299+299+299+299}{6}\\ &= \frac{\text{R } 1893}{6}\\ &= \text{R } 315{,}50\end{aligned}$$

11. Total excluding VAT = R 262,28
    14% of R 262,28 = R 262,28 $\times \frac{14}{100}$ = R 36,72

Activity 4 – 2: Understanding a phone bill

Oliver receives the following cell phone bill. Answer the questions that follow on the next page.

d1COM / 204 / 01 / 0020905 / 041809

L9243867-2
OLIVER MICHAELS
407 MONTFRERE
1 CLAIR STREET
WESTDENE
BLOEMFONTEIN
6523

Tax invoice

Account number: L9243867-2
Date: 03/07/2012
Your VAT registration number:

All data Contract customers on any data bundle will qualify for additional data to be used between midnight and 5am, e.g. if you have a MyMeg 250, you will get another 250MB of Night Owl. This offer excludes Top Up and Prepaid customers. T&Cs apply.

Account summary:

Date	Description	Item number	Reference	Amount	Total
04/06/2012	Balance Brought Forward			99.00	99.00
02/07/2012	Payment	SCZ1399863	159019863	-99.00	0.00
03/07/2012	Invoice	B227108838	726371238	99.00	99.00

Invoice summary:

Cellular number: 0731456720
Invoice number: B227108838
Due date: 31/07/2012

Description		Amount	VAT	Total
Subscription Services				
Data Promotion - Top Up MyGig1	July	86.84	12.16	99.00
HSDPA Voice Tariff	July	0.00	0.00	0.00
VAS - Balance Notification	July	5.70	0.80	6.50
VAS- Free Balance Notification	July	-5.70	-0.80	-6.50
Total Subscription Services		**86.84**	**12.16**	**99.00**
Subtotal		**86.84**	**12.16**	**99.00**
This invoice amount		**86.84**	**12.16**	**99.00**

>>> 9 2060 1903 149 721 9

Invoice Total 99.00

Page 1 of 1

Your bank account will be debited with the full outstanding balance as reflected on this statement on the 1 August 2012

Vodacom (Pty) Ltd. Registered office. P O Box 3306 Cramerview 2060. Company Registration No. 1993/003367/07. V.A.T Registration No. 401013921

1. What is the balance brought forward from the previous invoice?
2. On what date was the payment of this balance made?
3. When is the payment for the current outstanding amount due?
4. What subscription service does Oliver get for free?
5. What subscription does Oliver get a full refund for?
6. What is the billing period for this invoice?
7. Oliver wants to query the last payment he made. List four things he could use as a reference number.
8. Oliver wants to check that the VAT calculated on the total amount due is correct. Show how he can do this. Show all your calculations.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24FK 2. 24FM 3. 24FN 4. 24FP 5. 24FQ 6. 24FR
7. 24FS 8. 24FT

Shopping documents EMG48

Till slips

Every time you buy an item from a shop, you should receive a till slip indicating the value of the item you bought, how much money you offered the cashier for it, how much change you received and so on. Till slips come in many different forms depending on which shop you're buying things from. By law however, South African till slips must include:

- the name of the shop.
- the address of the shop.
- the VAT number of the shop.
- the words "Tax Invoice".
- the shop's invoice number.
- the date and time of the sale.
- a description of the items or services bought.
- the amount of VAT charged (14%).
- the total amount payable.

It is important to know that VAT is not charged on some essential groceries in South Africa. These include: paraffin; brown bread; maize meal; samp; mealie rice; dried mealies; dried beans; lentils; tinned sardines; milk powder; milk, rice; vegetables; fruit; vegetable oil and eggs.

Worked example 5: Understanding till slips

QUESTION

Boiketlo goes to buy her groceries at the Sunshine Superette. Study the till slip below and answer the questions that follow:

SUNSHINE SUPERETTE

Welcome to our Store
7th Street Melville
Tel No: 011 482 1092
VAT NO 1340763486
---TAX INOIVCE---
Retain as proof of purchase

LAST DAY FOR A FULL REFUND IS 27/07/2013

VEGETABLE SOUP INST	R6.95
MINI TENNIS BISCUIT	R3.95
50G BILTONG	R19.99
24 LITRE VTC (FOODS)	R0.44
500ML VEG OIL	R16.99 *
YOGHURT 175G	R5.49
BREAD/BROWN	R6.99 *
1L MILK/LOW FAT	R11.95 *
COTT/CHEESE 250G	R15.99
SHAMPOO	R15.99
MUFFINS/CHOC	R13.95
11 BALANCE DUE	**R130.27**
CASH PAYMENT	**R150.00**
CHANGE	**R19.75**

Rate	Vat	TOTAL
14.00%	11.59	94.34
* 0.00%	0.00	35.93

28/05/2013 18:15
CASHIER - Babalwa Noza

Visit Our Website www.sunshinesuper.co.za
Customer helpline 086 1456 345

1. How did Boiketlo pay for her shopping?
2. How much does 1 litre of vegetable oil cost at the Sunshine Superette?

3. If there are 6 muffins in the pack of chocolate muffins that Boiketlo buys, how much does each muffin cost?
4. What is the last date for a refund and why might Boiketlo need one?
5. Boiketlo gave the cashier R 150,00 and received R 19,75 change.
   a) Calculate what she paid for her shopping.
   b) Why do you think amount slightly different to the balance due?
6. Why do you think three items (vegetable oil, brown bread and milk) have stars next to them?
7. a) Add up the total of the items which to which are subject to VAT.
   b) Calculate the VAT (14%) of the total value of these items. Which letter (A, B, C or D) on the till slip does this correspond to?
   c) Add the 14% VAT to the total value of the items which are subject to VAT. Which letter (A, B, C or D) on the till slip does this correspond to?
   d) Add up the total of the three items that are exempt from VAT. Which letter (A, B, C or D) on the till slip does this correspond to?
   e) Add together the total (including VAT) of the items that include VAT and the total of the VAT exempt items. Which letter (A, B, C or D) on the till slip does this correspond to?

SOLUTION

1. She paid with cash.
2. 500 ml of vegetable oil costs R 19,99, so 1 litre costs R 19,99 $\times$ 2 = R 39,98.
3. 6 muffins cost R 13,95, so one muffin costs R 13,95 $\div$ 6 = R 2,33
4. 27/07/2013. She may need a refund if the food she bought is stale.
5. a) R 150,00 - R 19,75 = R 130,25.
   b) The amount she paid is 2c less than the balance due. The total has been rounded down to the nearest multiple of 5c to accommodate for the fact that we no longer use 2c and 1c coins in South Africa.
6. The three starred items are exempt from VAT
7. a) R 6,95 + R 3,95 + R 19,99 + R 0,44 + R 5,49 + R 15,99 + R 15,99 + R 13,95 = R 82,75
   b) 14% of R 82,75 = 82,75 $\times \frac{14}{100}$ = R 11,59
   Letter B

c) R 82,75 + 11,59 = R 94,34
Letter C

d) R 16,99 + R 6,99 + R 11,95 = R 35,93
Letter D

e) R 94,34 + R 35,93 = R 130,27
Letter A

Activity 4 – 3: Understanding till slips

Sakhile goes to his local department store and buys some clothes and groceries. He receives the following till slip. Study the slip and answer the questions that follow:

GREEN MARKET STORE

Welcome to our Store
21 Brickfields Rd
Tel No: 031 645 1228
VAT NO 156892340875
Retain as proof of purchase

LAST DAY FOR A FULL REFUND IS 18/04/2013
Except for SALE items purchased

T-SHIRT/RED		23.99	
R45.99 less sale 50% R23.99			
TRACK PANTS/GREY		89.99	
SARDINES/200G TIN	2@	5.99	*
BISCUIT/GINGER 500G		14.49	
0.5L MILK		6.95	*
TOMATOES 1KG		11.95	*
EGGS 6 JUMBO	2@	7.99	*
SUNDAY TIMES NEWS		15.99	
CRISPS/CHEESE		6.69	

***** TOTAL** 219.17 — B

CARD FNB 219.17
ACCOUNT NR ************47654
CHANGE 0.00

Total Promotion Disc 23.99
------------TAX INVOICE ------------
14% VAT 21.16 — A
VAT TOTAL 21.16
---------VALID VAT INVOICE ---------

18/03/2013 13:10
CASHIER - James Hetfield

1. What item did Sakhile buy on sale, and how much was the discount?
2. Can Sakhile return the sale item for refund? Explain your answer.

3. Sakhile finds a hole in the tracksuit pants that he bought.

    a) Can he return them for a refund?
    b) If so, by what date must he return them?

4. How many eggs did Sakhile buy?
5. Calculate the total value of the VAT exempt items Sakhile bought.
6. Demonstrate how the amount indicated by Letter A was calculated. Show all your calculations.
7. Demonstrate how the amount indicated by Letter B was calculated. Show all your calculations.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24FV 2. 24FW 3. 24FX 4. 24FY 5. 24FZ 6. 24G2
7. 24G3

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Account statements

At some clothing and food stores, it is possible to open an account, buy goods on credit and pay off what you owe the store on a monthly basis. Buying on credit basically means that you can take the items now and pay for them later. While this may seem like a good idea, it is all too easy to end up owing the shop more money you can pay them, which is a very bad position to be in. Many South Africans do have store accounts and manage them sensibly by paying back the shop each month, when they receive their monthly account statement.

In order to open a store account, you usually have to be 18 years or older, and be able to provide proof of employment and proof of residence. You are then issued with a store card (like a credit card but only for certain shops), and you receive monthly account statements detailing how much you've spent, how much you've paid back and how much you still owe the store.

Worked example 6: Understanding shop accounts

QUESTION

Bulelwa has an Edgars store account. She receives the account statement below. Study the statement and answer the questions that follow:

TEMPTATIONS
Pay your total due every month to have credit when you need it

MISS BN DUBE
25 HARRINGTON HOUSE
BEACH RD
PORT ELIZABETH

7450

CREDIT AVAILABLE
3307.00

Date:
07/05/12
Account Number:
4056747070001001001

MISS BN DUBE	
4056747070001001001	
Instalment:	240.00
Overdue:	0.00
Total Due:	**240.00**
Due Date:	01/06/12
Amount Enclosed:	

Edgars, Boardmans, Prato, Temptations and CNA trading as divisions of Edcon (Pty) Limited
1 Press Avenue, Crown Mines, 2092. Registration No. 2007/003525/07 NCR Reg. No. NCRCP82

STATEMENT

EMAIL: ACCOUNTSCTN@EDCON.CO.ZA

DATE	REF NO:	DETAILS	AMOUNT	BALANCE
		OPENING STATEMENT BALANCE		692.42
25/04/12		ATM PAYMENT	240.00-	452.42
		6 MONTHS PLAN		
24/04/12		PURCHASE EDG WALMER PARK	99.95	552.37
25/04/12		PURCHASE EDG WALMER PARK	190.00	742.37
		CLOSING STATEMENT BALANCE		742.37

Use the Account Number above as your Reference number if you are paying electronically, and please ensure your bank links your payment to the following bank account:

FNB BRANCH CODE 251105
ACCOUNT NUMBER 50451141440

PLEASE NOTE: Even if you don't receive a statement every month, you must pay Total Due to avoid late payment charges

CREDIT LIMIT
You now have: / You qualify for: 4049

For credit limit increases, account enquiries and address or telephone number changes call:

0860 112 442
(South Africa, Lesotho and Swaziland)
061 225 432
(Namibia)
0800 133 268
(Botswana)

Office Hours:

Mon-Wed	08:00 - 18:00
Thur	08:00 - 19:00
Fri	08:00 - 21:00
Sat	08:00 - 18:00
Sun & Public Hol	09:00 - 17:00

Late charges at 22.10%PA will be added to overdue accounts.

A 50.00 service administration fee will be charged on all processed payments that have been dishonoured.

FROM 6 MAY 2012, THE PREMIUM ON YOUR EDGARS ACCOUNT PROTECTION PLAN AND/OR ACCOUNT PARTNER PROTECTION PLAN WILL INCREASE FROM 33 CENTS PER 100.00 TO 35 CENTS PER 100.00. FOR FURTHER INFORMATION CALL 0860 112 442.

If you prefer that Edcon (Pty) Limited does not send you advertising material to offer you promotional goods and services, please contact 0860112442 to remove your name from our advertising lists.

If no query is received within 30 days of this statement, then it will be deemed that all postings are correct.

1. At which six stores can Bulelwa use her store card?
2. a) How much does Bulelwa owe on her account?
   b) When is this amount due?
   c) Will Bulelwa incur extra costs if she pays the due amount late? If so, how much?
3. How much did Bulelwa pay into her account on 25/04/2012?
4. a) How much credit does she still have available, and what do you think this means?
   b) What do you think the difference between "credit available" and "credit limit" is?
5. How much is the balance brought forward from the previous statement?
6. How much did Bulelwa spend at Edgars in the month of April 2012?
7. The closing balance on this statement includes 14% VAT Calculate the VAT included in the closing balance of R 742,37.

SOLUTION

1. Edgars, Boardmans, Prato, Temptations, CNA and Red Square
2. a) R 240,00
   b) 01/06/2012
   c) Not on this account, no. But if her payments remain overdue for a year or more there is an additional charge of 22,10% per annum (per year)
3. She paid R 240,00 into her account.
4. a) Bulelwa has R 3307,00 credit available. This means that she can still buy items up to the total value of R 3307,00 on her account.
   b) Credit available is how much credit Bulelwa has left. Credit limit is how much credit she is allowed in total, at any one time (i.e. she can buy items totalling R 4049 on credit).
5. R 692,42
6. R 99,95 + R 190,00 = R 289,95
7. 14% of R 742,37 = R $742{,}37 \times \frac{14}{100} = 103{,}9318 \approx$ R 103,93

Activity 4 – 4: Understanding shop accounts

Jane receives the account statement on the opposite page from Woolworths. Answer the questions that follow.

WOOLWORTHS FINANCIAL SERVICES

STATEMENT DATE	12 SEP 2013
PAYMENT DUE DATE	07 OCT 2013
ACCOUNT NUMBER	5708 8501 **** ****
INSTALMENT FREQUENCY	Monthly

JANE@GMAIL.CO.ZA

Woolworths Financial Services PO Box 5553 Cape Town 8000
21 Howe Street, Observatory, Cape Town, 7925
Telephone 0861 50 20 20 Fax 0861 99 91 94
Woolworths Financial Services (Pty) Ltd Reg no 2000/009327/07
A registered credit provider NCRCP49 Email: wwfs@woolworths.co.za

STORE CARD STATEMENT

YOUR TRANSACTION DETAILS

Page 1

DATE	STORE	DESCRIPTION	AMOUNT
		OPENING BALANCE	4318.33
13 AUG 2013	NICHOL WAY - JHB	PURCHASE -FOODS,CONDIMENTS DRE	302.03
15 AUG 2013	NICHOL WAY - JHB	PURCHASE -FOODS	171.74
19 AUG 2013	CAPE TOWN AIRPOR	PURCHASE -CUT FLOWERS,FOODS,PL	152.15
22 AUG 2013	NICHOL WAY - JHB	PURCHASE -FOODS	279.67
23 AUG 2013	SUMMIT ROAD	PURCHASE -PURCHASE	55.19
25 AUG 2013	NICHOL WAY - JHB	PAYMENT - THANK YOU	400.00 CR
12 SEP 2013	HEAD OFFICE	INTEREST	70.36

CLOSING BALANCE **4949.47**

GET PEACE OF MIND BY ADDING BALANCE PROTECTION TO YOUR ACCOUNT. TO FIND OUT MORE CALL 0861 50 20 40.
PLEASE NOTE RATE CHANGE TO 14% ON BALANCES ABOVE R10 000 AND TO 17% ON BALANCES BELOW R10 000 EFFECTIVE 27 JULY 2012.

Minimum Payment	R371.21	**Overdue**		**Credit Available**	R251.00
Payment Due Date	07 OCT 2013	**Credit Limit**	R5200.00	**Closing Balance**	4949.47

Please note: If payment of full balance is not received by payment due date, interest is charged on full balance and on new purchases.

Banking Details:
Bank: ABSA Bank
Account Holder: WFS Instore Cards Direct Deposits
Bank Account Number: 4072263822
Branch Code: 632005
Swift Code: ABSAZAJJ
Beneficiary Reference: Please use your Woolworths account number as it appears on your Woolworths Store Card as the payment reference

44/0067202
NTT-I/O-01

1. Is there anything unusual about Jane's contact details, when compared to the bills we've worked with thus far?
2. What is the opening balance on Jane's account?

3. When last did she make a payment into her account and how much was it for?
4. How many times did Jane shop at Woolworths in the month of August 2013?
5. How much did she spend in total on goods from Woolworths in August 2013?
6. Which Woolworths store did she shop at the most often?
7. Jane lives in Johannesburg. Did she travel at all in the month of August 2013? Explain your answer.
8. What is the minimum amount that Jane must pay into her account this month, and when must she pay it by?
9. How much credit does Jane have available?
10. How much does she owe in total to Woolworths?
11. Jane is interested in getting the credit card advertised at the bottom of the account statement. With this new credit card, if she spent R 400 at Woolworths, how much would money would she get back in WVouchers?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24G4 2. 24G5 3. 24G6 4. 24G7 5. 24G8 6. 24G9
7. 24GB 8. 24GC 9. 24GD 10. 24GF 11. 24GG

4.3 Tariff systems EMG49

DEFINITION: *Tariff*

A list or schedule of pre-determined prices for services like trains, busses, and electrical usage.

Tariffs are pre-determined rates that are used to determine how much money you owe for a given service. For example, the total amount of money you owe on your municipal bill is calculated using predetermined tariffs. A tariff usually includes a unit of payment with a unit of measurement - for example cell phone bills are charged in cents or rands per minute (R/minute) and electricity is charged in cents per kilowatt hour or c/kWh. Telkom charges monthly landline rental in Rands per month.

In this section you will work with different tariff systems, learn how to calculate costs using given tariffs and how to draw and interpret graphs of various tariff systems.

Municipal tariffs EMG4B

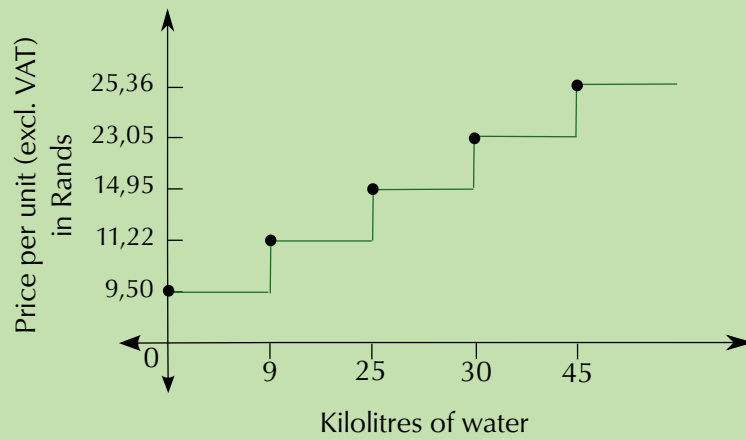
Municipal tariffs include tariffs for electricity, water and refuse removal. They differ from one city to the next, but generally speaking, the more electricity or water you use in a month, the more expensive it is per unit. Sometimes municipal tariffs are also called "rates". Your municipal bill also usually includes a monthly property rate based on the municipal value of your house - again, the more your house is worth, the more you will pay in rates.

Worked example 7: Working with tariffs

QUESTION

The City of Durban's Ethekwini Municipality charges the following tariffs for domestic water usage in 2013, for properties valued at more than R 250 000:

	Price per kilolitre, excluding VAT
0 kl to 9 kl	R 9,50
from 9 kl to 25 kl	R 11,22
From 25 kl to 30 kl	R 14,95
from 30 kl to 45 kl	R 23,05
more than 45 kl	R 25,36

1. Megan's monthly water consumption is 12 kl. Calculate her monthly water costs, **excluding** VAT.
2. Gilbert's monthly water consumption is 32 kl.
   a) Calculate what his monthly water bill will be, **including** VAT.
   b) Calculate what Gilbert will pay on average, per kilolitre of water.
3. Study the following graph, showing the relationship between the quantity of water used and the price **per unit**, as given in the above table:

Why do you think the graph is a series of horizontal lines and sudden vertical rises?

SOLUTION

1. To calculate Megan's total water costs, we break up her usage into the different tariff categories:
   In the 0 kl - 9 kl category, she used 9 kl of water
   In the 9 kl - 25 kl category, she used 3 kl of water (9 kl + 2 kl = 12 kl)
   Now we calculate how much the number of kilolitres used in each category cost:
   9 kl $\times$ R 9,50 = R 85,50
   3 kl $\times$ R 11,22 = R 33,66
   Next we add these two subtotals together:
   R 85,50 + R 33,66 = R 119,16
   So her water usage for the month will cost R 119,16, excluding VAT

2. a) To calculate Gilbert's total water bill, we break the 32 kl up into the different tariff categories listed in the table above.
   In the 0 kl - 9 kl category, he used 9 kl of water
   In the 9 kl - 25 kl category, he used 16 kl of water (9 + 16 = 25 kl)
   In the 25 - 30 kl category, he used 5 kl of water (25 + 5 = 30 kl)
   In the 30 - 45 kl category, he used 2 kl of water (30 + 2 = 32 kl)
   Now we calculate how much the number of kilolitres used in each category cost:
   9 kl $\times$ R 9,50 = R 85,50
   16 kl $\times$ R 11,22 = R 179,52
   5 kl $\times$ R 14,95 = R 74,75
   2 kl $\times$ R 23,05 = R 46,10
   Next we add these subtotals together to get the total, excluding V.A.T:
   R 85,50 + R 179,52 + R 74,75 + R 46,10 = R 385,87
   Lastly, we calculate what the 14% VAT on the above total is, and add it to the total to get the final amount:
   14% of R 385,87 = R 385,87 $\times \frac{14}{100}$ =R 54,0218
   R 385,87 + R 54,0218 $\approx$ R 439,89
   So Gilbert's total water costs will be R 439,89. (Note how we only round down at the last step, to make the calculation more accurate.)

   b) Gilbert pays R 439,89 for 32 kl of water.
   $\frac{\text{R } 439{,}89}{32 \text{ kl}} \approx$ R 13,75 per kilolitre.

3. Because the price stays the same from 0 kl to 9 kl, for example, a **horizontal** line is drawn between 0 and 9. The dotted **vertical** lines show us how the price suddenly increases when we move into the next group of kilolitres (9-25 kl). The same applies for 9 - 25 kl, 25 - 30 kl etc. We cannot join the points with a sloping line, because this suggests the price **per unit** rises with each kilolitre, which is not the case, rather the price is constant for a given range of kilolitres (and therefore the graph is flat) and then increases suddenly for each new category of water usage.

Activity 4 – 5: Calculating costs using given municipal tariffs

Domestic electricity in the City of Cape Town is charged for using the tariffs below, for households who use more than 450 kWh of electricity per month. They refer to each category of electricity usage as a block, and the tariffs are charged in **cents** per kilowatt hour (kWh). VAT is included in the tariff costs listed below.

Block number (kWh)	cents per kWh (incl VAT)
Block 1 (0 - 150 kWh)	129,05
Block 2 (150,1 - 350 kWh)	134,65
Block 3 (350,1 - 600 kWh)	134,65
Block 4 (> 600 kWh)	159,81

1. If Jason's household uses 140 kWh of electricity in a month, calculate what his electricity bill will be, in Rands.
2. Thomas uses 200,5 kWh of electricity in a month. What will his electricity costs be in Rands?
3. The City of Cape Town decides to introduce a fixed additional tariff for anyone who uses more than 350 kWh of electricity. This fixed cost is R 24,45 per month. (I.e. the cost is R 24,45 plus the price per units used). If Neil uses 423 kWh of electricity in a month, calculate what his total electricity cost will be.

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1. 24GH 2. 24GJ 3. 24GK

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Telephone tariffs EMG4C

Fixed phone line and cell phone service providers also commonly charge you for calls using tariffs. The tariff cost can be influenced by factors like the distance of the call (e.g. calls overseas are always more expensive than local calls) and the time of day (most service providers offer cheaper rates in the evenings, depending on which phone package you use).

Worked example 8: Working with telephone tariffs

QUESTION

Telkom charges for normal, national landline calls according to the following tariffs:

Distance	**Basic, fixed charge in Rands (incl. VAT) (regardless of length of call or distance)**	**Rands per second (incl. VAT)**	**Rands per second (incl. VAT)**
	All times	Standard Time	Callmore time
		Mon - Fri 07:00 to 19:00	Mon to Fri 19:00 - 7:00 and Fri 19:00 - Mon 7:00
Local (0 - 50 km)	0,570	0,00700	0,00344
Long distance (>50 km)	0,570	0,00950	0,00475

1. What two factors can influence the cost of a landline call, based on the information above?
2. Davina calls her mother, who lives 25 km away, during standard time.
   a) If she talks for 1000 seconds, what will she pay for the call, in Rands?
   b) For how many minutes did they talk? (Round your answer **down** to the nearest minute).
3. Graham calls his aunt, who lives 100 km away, during Callmore time. They talk for 5 minutes. How much will the call cost him?

4. Karabo calls his friend at 5 p.m. on a Saturday. They chat for 10 minutes. If his friend lives 5 km away, calculate how much the call with cost Karabo.

SOLUTION

1. The distance of the call, and the duration (number of seconds)
2. a) Cost of call = minimum charge + (Rands per second) × (number of seconds)
   = R 0,570 + (R 0,00700) × 1000
   =R 0,570 + R 7,00
   =R 7,57

   b) 1000 seconds ÷ 60 seconds ≈ 16 minutes
3. Cost of call = minimum charge + (Rands per second) × (number of seconds)
   = R 0,570 + (R 0,00475) × (5 minutes)
   = R 0,570 + (R 0,00475) × (5 minutes × 60)
   = R 0,570 + (R 0,00475) × (300 seconds)
   = R 0,570 + R 1,425
   = R 1,995
   ≈ R 2,00
4. 5 p.m. on a Saturday is during Callmore time, therefore we use the tariffs given in the last column of the table.
   They chat for 10 minutes which is 10 minutes × 60 = 600 seconds.
   Cost of call = minimum charge + (Rands per second) × (number of seconds)
   = R 0,570 + (R 0,00475) × (600 seconds)
   = R 0,570 + R 2,85
   = R 3,42

Activity 4 – 6: Interpreting and comparing graphs of a tariff system

A local cellular provider charges the following for a standard contract:

- Monthly subscription: R 100
- Mandatory itemised billing: R 22

This monthly contract includes R 140 worth of airtime and R 40 worth of free, local SMS's.

Calls and SMS's are charged for using the tariffs given below. This service provider uses per second billing, so the tariff is Rands per 60 seconds of call time, even if those 60 seconds are split over two or more calls. Assume that these tariffs, or rates, and the monthly subscription are VAT inclusive. (An SMS is a text message, and an MMS is a text and data message, that may include a photo, for example).

Rate per minute for the first 5 minutes of the day	R 1,95
Rate per minute (60 seconds) thereafter	R 1,55
Calls to same network	R 0,99 per 60 seconds
International SMS	R 1,20 per SMS
SMS	R 0,60 per SMS
MMS	R 0,75 per MMS

1. Alfred has a contract like the one above. Assuming he does not use more than R 140 airtime in a month and R 40 worth of SMS's, what will his monthly cell phone bill cost?
2. On the first day of the month, the first call Alfred makes is to his father (on a different network) and they talk for 2 minutes. How much will this call cost Alfred?
3. On the same day, Alfred then calls his friend, Ivan. They talk for 4 minutes. How much will this second call cost him?
4. Later that afternoon, Alfred checks his phone and sees he has made 9 minutes, 25 seconds worth of calls.
   a) How many seconds is this?
   b) If he now calls his friend Azra, who is on the same network, and they talk for 360 seconds, how much will the call cost him?
5. Two weeks later, Alfred has made R 70,45 worth of calls, sent 25 local SMS's, 5 international SMS's and 2 MMS's. Calculate how much airtime he has left.
6. Alfred wants to buy an SMS bundle that he thinks is a good deal. With this bundle, he will get 125 SMS's for an extra R 78,75 per month (over and above the 40 free SMS's he already gets).
   a) How much will each of the 125 SMS's in the new bundle cost him?
   b) Is this a better deal than what he currently pays for his non-free SMS's?
7. Alfred calls his sister for a big chat, and accidentally uses all of his R 140 airtime in one day (assume this happened at the beginning of the month and he did not send any SMS's). If she is on a different network, how long did they talk for? Round your answer to the nearest minute, and write it in hours and minutes.

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1. 24GM 2. 24GN 3. 24GP 4. 24GQ 5. 24GR 6. 24GS
7. 24GT

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Transport tariffs EMG4D

Transport tariffs work much the same as municipal and phone tariffs. They may apply to train travel, busses and taxis. Generally, transport tariffs are charged per unit of distance, and the further you need to travel, the higher the tariff and therefore the more expensive your ticket. Like some basic foods, transport fares for taxis, buses and trains in South Africa are exempt from VAT.

Worked example 9: Working with transport tariffs

QUESTION

The municipal MyCiTi bus system in Cape Town charges the fares below. For all routes except the Airport route, you need to have a **my**connect card. For the airport route, you can still use paper tickets, which you can buy at the bus stops at either end of the route.

Cost		Route name
R 23	**my**connect card	
R 5,30	Gardens - Civic Centre - Waterfront Big Bay - Table View - Parklands East Parklands East - Table View - Blouberg Sands Marine Circle - Table View - Blouberg Sands	F1 F14 F15 F16
R 10,60	Table View - Civic Centre	T1
Free	Children under 1 m tall and under 4 years old	(all routes)

Airport Service

Cost		Route name
R 57	Civic Centre - Airport route	A1
R 28,10	Civic Centre - Airport route for children 4 - 11 years old	A1
Free	Children under 1 metre tall and under 4 years old	A1
R 499,50	Monthly ticket offering unlimited travel on the Airport - Civic Centre route (A1). This ticket cannot be used by anyone else and must have the name of the ticket holder on it. Write your name on the ticket as soon as buy it.	A1

1. Marissa lives near the Waterfront and goes to school in Gardens. She decides to investigate the MyCiTi bus system, route F1.
    a) What will the bus ride from the Waterfront to Gardens cost her the first time, and why?
    b) After her first bus trip, how much will the journey cost, per trip?
    c) If she makes 10 trips a week (5 days to school and back again) what will she be paying per week?
    d) Marissa's mother currently drives her to and from school and estimates that she spends R 13,62 on petrol per day, just for school lifts.
        i. How much is Marissa's mother spending on petrol for school lifts per week?
        ii. How much money will Marissa save her mother by using the MyCiTi bus instead of travelling by car?
2. Thuso's family wants to take the bus from the Civic Centre to Tableview, to go to the beach for the day. He is going with his parents and his aunt, his younger sister and his twin brothers who are 3 years old. How much will a one way trip to the beach cost the family, if both Thuso and his sister (who are both teenagers) have **my**connect cards but no one else in the family does?
3. Karen lives in Johannesburg but regularly travels to Cape Town for work. Her Cape Town office is based near the Civic Centre, so it is convenient to catch the MyCiTi bus from the airport to the Civic Centre in town.
    a) How much would a single trip from the airport to the Civic Centre cost her?
    b) On average, Karen makes 5 round trips (from the airport to the Civic Centre and back again) in a month.

i. Is there a cheaper bus fare or package she could use?
ii. If she buys the unlimited monthly Airport ticket, how much will each trip cost her? Is this cheaper than buying single trip tickets?

SOLUTION

1. a) She has to buy a **my**connect card to use the bus, so the first trip will cost her R 23,00 (for the card) + R 5,30 (for the bus ride) or R 28,30 in total.
   b) Thereafter it will only cost her R 5,30 per trip.
   c) R 5,30 $\times$ 2 trips per day $\times$ 5 = R 53,00 per week
   d) i. R 13,62 $\times$ 5 days = R 68,10 per week
      ii. R 68,10 - R 53,00 = R 15,10. Marissa will be saving her mother R 15,10 per week.

2. Thuso's parents and aunt will all need to buy **my**connect cards, so their fares will cost
   3 $\times$ (R 23,00 + R 10,60) = 3 $\times$ R 33,60 = R 100,80
   Thuso and his sister already have cards, so they only pay for the trip:
   2 $\times$ R 10,60 = R 21,20
   His baby brothers travel for free because they are under the age of 4.
   So the total cost is: R 100,80 + R 21,20 = R 122,00.

3. a) R 57,00
   b) i. Yes - she could investigate the monthly, unlimited travel option between the Airport and the Civic Centre.
      ii. The monthly rate is R 499,50. 5 round trips = 10 one way trips.
      R 499,50 $\div$ 10 = R 49,95 per trip.
      This is much cheaper than R 57 per trip!

Activity 4 – 7: Working with transport tariffs

Metrorail in Gauteng charges the following tariffs for Metro (Standard) Class tickets for different zones:

Zone	Single	Return	Weekly	Monthly
1 - 19 km	4,00	7,50	22,00	81,50
20 - 29 km	5,00	9,50	27,50	97,00
30 - 39 km	6,00	11,50	32,50	112,00
40 - 49 km	7,50	14,50	34,00	123,00
$>$ 50 km	9,50	18,50	38,50	140,00

1. Chuma travels 15 km on the train every day to school and back again. She buys a single ticket for every trip that she makes.
   a) how many trips will Chuma make (to school and back) in one month (4 weeks)?

b) How much will this cost her, if she buys single tickets?

c) How much cheaper will a monthly ticket be?

d) If she buys a monthly ticket for R 81,50, how much will each trip cost her?

e) How much cheaper than a single ticket is this?

2. Lindiwe has a monthly ticket and travels a distance of 35 km, return, every day.

    a) How much does her monthly ticket cost her?

    b) Lindiwe's friend tells her that it's possible to get a 20% discount if you're a scholar, wearing your school uniform. What would her monthly ticket cost with a 20% discount?

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1. 24GV   2. 24GW

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4.4 End of chapter activity EMG4F

Activity 4 – 8: End of chapter activity

1. Simon gets the following municipal bill for his property rates and refuse removal.

TAX INVOICE

joburgconnect@joburg.org.za

Page 1 of 2

TAX INVOICE

MOLESHE, SB
PO BOX 46216
JOHANNESBURG
2019

VAT NO.: CITY OF JOHANNESBURG: 4760117194
VAT NO.: JOHANNESBURG WATER 4270191077
VAT NO.: PIKITUP: 4790191292
VAT NO.: CITY POWER 4710191182

Date	2013/06/26
Statement for	June 2013
Physical Address	128 MYRTLE ROAD
Stand No./Portion	00001321 - 00000
Township	FOURWAYS EXT.1

Stand Size	Number of Dwellings	Date of Valuation	Municipal Valuation
920 m2	1	2008/07/01	Market Value R 2,920,000.00

Invoice Number: 34000962412
Client VAT Number:
Deposit: R 0.00

Account Number: 209395735 (Pin code: 016759)

Previous Account Balance	**1,172.33**
Less: Incoming Payment (Last Payment Made 2013/06/25)	**-3,700.00**
Sub Total	**-2,527.67**
Current Charges(see reverse for detail)	**1,646.76**

90 DAYS +	60 DAYS	30 DAYS	CURRENT	INSTALMENT PLAN	TOTAL AMOUNT OUTSTANDING
0.00	0.00	0.00	-880.91	0.00	-880.91

TOTAL DUE	R - 881.00
DUE DATE	2013/06/26

Introducing our new contact number: 0860 Joburg. Your City, Your Number - Starts 1 June 2013.

Joburg

Remittance Advice:

This stub must accompany payment, please do not detach if paying at the post office

Date: 2013/06/26 MOLESHE SB
Acc No.: 209395735 128 MYRTLE ROAD

>>>>>>> 91115 2023957398

0146 202395739

ABSA

City of Johannesburg Bank Acc. No 405 439 8463
Branch Code 632005
Client Account No/Deposit Reference 202395739

516008800111159 20239573906

Total Due	R - 881.00
Due Date	2013/06/26

13906

Account Number: 209395735		Page 2 of 2
Property Rates VAT No.: 4760117194	**Subtotal**	**Total Amount**
Category of Property: RESIDENTIAL: A		
The property rates are based on the market values of the property and are calculated as follows:		
R 2,920,000.00 X R 0.0052580 / 12 (Billing Period 2013/06)	1,279.45	
Less rates on first R150 000.00 of market value	- 65.73	
VAT: 0 %	0.00	1,213.72
Refuse VAT No.: 4790191292	**Subtotal**	**Total Amount**
Domestic refuse charges are based on the value of the property. Institutions and commercial charges are based on a per service charge.		
Refuse removal: 1-bin @ R 189.93 (Billing Period 2013/06)	379.86	
VAT: 14.00%	53.18	433.04
Current Charges		1,646.76

a) What city does he live in?

b) When last did he make a payment into this account, and how much was this payment for?

c) How much was the balance brought forward from his previous account?

d) How much is he being charged for property rates and refuse for the current billing period?

e) Why is the total due a negative amount?

f) What does Simon pay for property rates per year?

g) Does he get any deductions on his annual property rates?

h) Does he pay VAT on his property rates?

i) Show how the municipality calculated the R 53,18 VAT on his refuse subtotal.

2. Lucia receives the following account for her phone line with Neotel:

Computer Generated

Statement

Ms Lucia Molepo
39 Ash Street
Obesrvatory, Johannesburg, Gauteng

2192

Invoice number:	S001998985
Account number:	R001365923
Invoice date:	01-10-2013
Payment due date:	23-10-2013
Bill period:	SEPTEMBER 2013
Current balance:	R 690.99
VAT REG NO.:	NOT AVAILABLE
Payment terms:	21 days

Account no.: R001365923

Date	Transaction	Amount	Effective balance due
01-09-2013	Opening balance	R 771.18	R 771.18
26-09-2013	Payment Allocated Payment Allocated	R 771.18	R 0.00
	Invoice - TI0218010078_R000000490533	R 690.99	R 690.99

Current	30 Days Overdue	60 Days Overdue	90 Days Overdue	120 Days Overdue
R 690.99	R 0.00	R 0.00	R 0.00	R 0.00

Banking details are on the last page

TOTAL DUE: R 690.99

Neotel (Pty) Ltd **Customer Care Number** 0800 333 636 **Reg No.** 2004/004619/07
NeoVate Park 44 Old Pretoria Road Midrand 2191 Gauteng South Africa
Tel 0800 333 636 **Fax** 086 637 7523 **Email** consumers@neotel.co.za **Web** www.neotel.co.za **V.A.T. registration no.** 48 00 22 44 55

Page 1 of 2

Please Note: When you hear three beeps after dialing a number it means that the number has been ported to another fixed line telecommunications operator. Such a call may be charged at a different rate from calls that stay on the Neotel network.

Neotel Payment Options

For your convenience, all accounts are subject to paying via debit order

Should your debit order payment be unsuccessful, you must make a payment with either options below

Option 1:
Cash deposit into our bank account:

Account name: Neotel (Pty) Ltd - Consumer
Bank: Nedbank
Account number: 1454 088 567
Branch number: 1454 05
Branch name: Corporate Client Services

Quote your reference number which is your Neotel account number.

Option 2:
You can pay by Electronic Fund Transfer (EFT).
Quote your reference number which is your Neotel account number.

For cash and EFT payments please note:
Your payment will reflect on your Neotel account within 7 working days from receipt of payment.

Standard terms and conditions apply to all contracts. Full details of these terms and conditions can be found at http://www.neotel.co.za .

a) What is the billing period for this invoice?

b) How many days does Lucia have to pay this bill?

c) Do the numbers listed under "Effective balance due" include VAT? explain your answer.

d) When last did she make a payment to Neotel and how much was it for?

e) Does Lucia have any overdue payments?

f) List two ways in which she can pay her account?

g) List four ways in which Lucia can contact Neotel if she wants to query this invoice.

h) The Neotel invoice does not show how much VAT was added to Lucia's bill. If the total before VAT was R 606,13, calculate how much VAT was added to get the total due. Show your calculations.

3. Alison receives the following till slip from The General Store in Upington:

THE GENERAL STORE

228 Main Rd
Upington
Tel No: 055 683 1228
VAT NO 1345789075

21-02-2013 10:15
CASHIER – Leroy Jenkins

BREAD/BROWN	6.99 *
FRUIT JUICE/1 L APPLE	11.45
SAMP 500G	10.39 *
BAKED BEANS 250G TINS	2 @ 6.50
FROZEN HAKE 300G	35.00
POWDER MILK/200G	5 @ 3.45 *
ORANGES 1 KG	11.99 *
TOILET PAPER 2-PLY/9 ROLLS	43.99
POTATOES 500G	19.99 *
TOTAL	184.53
	0.03
CASH	200.00
CHANGE	15.50

------------TAX INVOICE------------
14% VAT 14.48
VAT TOTAL 14.48
---------VALID VAT INVOICE---------

a) How did Alison pay for her shopping?

b) Calculate the total cost of VAT exempt items on the till slip.

c) Calculate the total cost of items that are subject VAT.

d) Calculate how much VAT is added to the VAT-inclusive items.

e) Show how the above three amounts make up the total due.

f) Alison paid with cash, and received R 15,50 change. This means she paid R 184,50 for her shopping. Explain why this amount is different to the Total of R 184,53.

g) How much will 1 kg of potatoes cost at The General Store?

h) If the store advertised a 20% discount on potatoes, how much will one kg of potatoes cost?

4. Michael receives the following invoice from Ivy Supermarket, where he has a store account:

IVY SUPERMARKET

MR MICHAEL BHEMBE
84 12TH ST
POLOKWANE
015 564 3949

STATEMENT DATE 5 MAY 2013
PAYMENT DUE 31 MAY 2013
ACCOUNT NUMBER 1456 9523 ****
BILLING PERIOD APRIL 2013

TAX INVOICE

DATE	DESCRIPTION	AMOUNT	BALANCE
4 APR 2013	**OPENING BALANCE**	R623.95	**R623.95**
5 APR 2013	PURCHASE - FOOD	R341.45	R965.40
8 APR 2013	PAYMENT - THANK YOU	-623.95	R341.45
12 APR 2013	PURCHASE - FOOD/CLOTHES	R245.50	R586.90
25 APR 2013	PURCHASE - FOOD	R184.49	R771.39

TOTAL EXCL VAT: R676.66
14% VAT: R94.73
TOTAL DUE: R771.39

Current	30 Days Overdue	60 Days Overdue	90 days Overdue
R771.39	R0.00	R0.00	R0.00

PAYMENT VIA ELECTRONIC FUNDS TRANSFER (EFT) OR CASH DEPOSIT

BANKING DETAILS
Account name: Ivy Supermarket. **Bank**: Standard Bank.
Account number: 1456 9234 0654. **Branch number**: 456 987

Ivy Supermarket. Tel: 015 734 9345. Shop 42 Riverside Mall. 342 Main Street, Polkiwane.
Reg No. 2006/0654345/08. VAT Registration No: 34 96 12 69 88

a) In what city does Michael live?
b) How many times did Michael shop at Ivy Supermarket in April 2013?
c) How much money did he owe from his previous invoice?
d) When last did he pay money into his account, and how much did he pay?
e) Name two ways in which Michael can pay his account.
f) If Michael receives his invoice in the post on 10 May 2013, how many **weeks** does he have to pay his bill?
g) Show how the R 94,73 VAT is calculated.
h) If Michael can only afford to pay R 350 into his account this month, what will his opening balance for June 2013 be?

i) Do you think Michael is responsible about paying his account on time? Explain your answer.

5. Buffalo City Metro gives the following tariffs for electricity for schools and sports fields in the East London area:

Energy Charge	Total Rands Excl. VAT	VAT Rands 14%	Total Rands VAT Incl.
First 2000 kWh	1,24566	0,17439	1,4200
Next 8000 kWh	0,92405	0,12937	1,0534
Above 10 000 kWh	1,29982	0,18198	1,4818
Minimum charge per month, or part thereof	164,32824	23,00595	187,3342

a) Buffalo High School uses 9000 kWh of electricity in one month.

i. How much will their electricity cost, before VAT is added?

ii. Calculate what the 14% VAT on the school's electricity bill will be.

iii. Calculate the total the school will pay for electricity in a month, including VAT.

b) Eastwood Primary School closes for the month of December, and uses no electricity during this period. What will the school's electricity bill be, including VAT?

c) Windyvale High School has a large campus and sports fields, and on average uses 11 000 kWh of electricity per month.

i. Calculate how much the school's electricity bill will be (including VAT).

ii. List at least three things that the school do to reduce its electricity consumption.

6. Neotel lists the following call tariffs for calls (per minute) from a Neotel phone to landlines (the prices below include VAT):

	Neotel to landline	Neotel to Neotel
Local - peak	R 0,34	R 0,17
Local - off peak	R 0,17	R 0,17
Regional - peak	R 0,46	R 0,34
Regional - off peak	R 0,29	R 0,34
National - peak	R 0,57	R 0,43
National - off peak	R 0,33	R 0,43
After hours calling (daily between 18h00 - 07h00, plus all day on weekends and public holidays)	-	Free

a) Wendy calls her friend Karabo, who lives nearby, from her Neotel landline, on a Wednesday afternoon. They talk for 540 seconds.

i. How much will the call cost if Karabo is with another phone provider?

ii. How much will the call cost if Karabo is also with Neotel?

b) Neo's mother lives in the Transkei. His mother has a Neotel phone line.

i. Neo lives in Johannesburg and has a non-Neotel phone line. If his mother calls him from the Transkei on a Saturday, what will the call cost her per minute?

ii. Will the call be cheaper the call be if Neo had a Neotel phone line that his mother could call him on?

iii. How much would a 420 second call cost, (from Johannesburg to the Tranksei, from a Neotel line to a Neotel line) if Neo called his mother at 20h30 on a Monday night?

7. Metrorail in Cape Town gives the following tariffs for normal Metro Class train travel from Cape Town Central Station:

Zone (km distance)	Single	Week	Month
1 - 10	R 6,00	R 39,00	R 117,00
Claremont, Esplanade, Hazendal, Kentemade, Koeberg Road, Maitland, Mowbray, Mutual, Ndabeni, Newlands, Observatory, Paarden Island, Pinelands, Rondebosch, Rosebank, Salt River, Thornton, Woltemade, Woodstock, Ysterplaat			
11 - 19	R 6,50	R 42,00	R 126,00

Akasia Park, Athlone, Avondale, Belhar, Bellville, Bontheuwel, Century City, Crawford, De Grendel, Diep River, Elsies River, Goodwood, Harfield Road, Heathfield, Heideveld, Kenilworth, Langa, Lansdowne, Lavistown, Monte Vista, Netreg, Oosterzee, Ottery, Parow, Plumstead, Retreat, Steurhof, Tygerberg, Vasco, Wetton, Wittebome, Wynberg			
20 - 30	R 7,50	R 49,00	R 147,00
Blackheath, Brackenfell, Clovelly, Eikenfontein, False Bay, Fish Hoek, Kalk Bay, Kuils River, Lakeside, Lentegeur, Mitchells Plain, Mandalay, Muizenberg, Nolungile, Nyanga, Pentech, Philippi, Sarepta, Southfield, St James, Steenberg, Stikland, Stock Road, Unibell			

a) Naledi wants to take the train from the city centre to Kalk Bay. How much will a single ticket cost her?

b) How much does a monthly ticket from Kuils Rivier to the Central Station cost?

c) Kevin takes the train every week day from Akasia Park to the Central Station and back.

   i. If he buys single tickets for each trip, how much will he pay per week for his train transport?
   ii. How much cheaper would a weekly ticket for the same route be?
   iii. If he buys a monthly ticket for the same route, for R 126,00, how much will he pay per trip?
   iv. How much cheaper is this than paying for a single ticket?

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1. 24GX 2. 24GY 3. 24GZ 4. 24H2 5. 24H3 6. 24H4
7. 24H5

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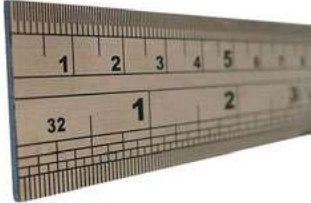
CHAPTER

Measuring length, weight, volume and temperature

5.1 Introduction and key concepts EMG4G

Knowing how to measure length, weight, volume and temperature is a skill that you will use often in a variety of different contexts. For example, you may want to know how far you've travelled in a car, how much baking powder you need to put in a cake, how long a tablecloth needs to be to cover a table, how big you can make a vegetable garden or how hot your oven at home must be to cook dinner.

As we have already seen in Chapter 3, measurements are useful for planning activities and projects like cooking, baking and gardening. Knowing what quantities we need allows us to calculate how much we need to complete the task at hand. It also means we can calculate how much we can or will have to spend on the items we need. We would not want to buy insufficient quantities of goods and we would not want to buy too much either (that would be wasteful and unnecessarily expensive!) It is therefore important that we measure our quantities so that we know exactly how much we need and can plan our finances accordingly.

In this chapter we will learn how to:

- estimate measurements.
- use different measuring instruments to accurately measure:
  - length and distance.
  - weight or mass.
  - volume.
  - temperature.
- calculate the cost of materials based on quantity and a given price, whilst including the conversions we learnt in Chapter 3.

5.2 Estimating and measuring length and distance EMG4H

We can estimate some lengths and distances using approximate values for measurements. For example, one metre is approximately the length from your shoulder to your fingertips, if you stand with your arm outstretched. A metre is also approximately the distance of one large step or jump.

Whilst estimating length and distance can be useful, we often need to know exactly how long something is. To measure accurately, we use measuring instruments. Some examples are given in the table on the next page:

	A **ruler** is usually has centimetre and millimetre units on it. They are most commonly 15 or 30 cm long. A ruler could be used to measure the length of small tin, or the length of a piece of paper, for example.
	A **measuring tape** has centimetre and metre units marked on it. Measuring tapes are useful for measuring lengths of cloth, or large household objects like furniture and rooms.
	The length around the circle (the circumference) of a **trundle wheel** is 1 m. When it is rolled across the floor, it makes a 'click' sound for every full rotation of the circle or 1 metre measured. Trundle wheels may be used to measure the length of a classroom, a corridor or a field, for example.
	An **odometer** (pronounced o-dom-e-ter) is a measuring instrument used in cars to measure the distance travelled. The displayed number increases by 1 unit for every kilometre the car travels. In the odometer on the left, this car has driven 100 000 km in total.

Worked example 1: Estimating and measuring length

QUESTION

Carl needs to measure the width of a window, to find out how much material he needs to buy to make a curtain. The curtain material costs R 55 per metre.

1. Carl estimates the width of the window (using his arm) to be 1,9 metres wide. If Carl goes to the shop with this estimate:
    a) How many metres of material would he need to buy?
    b) How much would the material cost?
2. Carl decides to double-check his estimated measurement before he buys the material and uses his tape measure to accurately measure the width of the window. He determines that the window is actually 2,2 m wide.
    a) How many metres of material does he need to buy?
    b) How much will the material cost?

SOLUTION

1. a) 2 m
   b) $2 \times$ R 55 $=$ R 110
2. a) 3 m (remember, the material is only available in units of 1 metre!)
   b) $3 \times$ R 55 $=$ R 165

This example shows us that while being able to estimate length is useful, in some situations it's important to be accurate! If Carl had used his estimated measurement instead of his tape measure, his cost estimate would have been too low and his curtain would have been too short to cover his window.

Worked example 2: Measuring length and calculating costs

QUESTION

Liz sews dresses for little girls. The material costs R 89,50 per metre and she needs 2 metres of material to make a dress for a 4 year old; 2,5 metres to make a dress for a 7 year old and 3 metres to make a dress for 10 year old. The embroidery cotton costs R 12,55 for a roll of 3 metres. She uses 2 rolls of cotton per dress.

1. How much material will she need to make the following four dresses: 1 dress for a 7 year old, 2 dresses for four year olds, 1 for a 10 year old?

2. What will the material cost for the four dresses?
3. What is the length of embroidery cotton that Liz is going to use when sewing one dress, in metres and centimetres?
4. What is the total amount that she going to pay for the embroidery cotton?
5. What is the total cost of a dress for a 10 year old?

SOLUTION

1. 2,5 m + 2 m + 2 m + 3 m = 9,5 m
2. Length of material × price
   = 9,5 m × R 89,50
   = R 850,25
3. Length of one roll of cotton × 2 = 3 m × 2
   = 6 m, or 600 cm per dress.
4. Number of dresses × 2 rolls of cotton per dress × price
   = 4 × 2 × R 12,55
   = R 100,40
5. (Length of material × Price) + (2 rolls of cotton × Price)
   = (3 m × R 89,50) + (2 × R 12,55)
   = R 268,50 + R 25,10
   = R 293,60

Activity 5 – 1: Measuring length and calculating cost

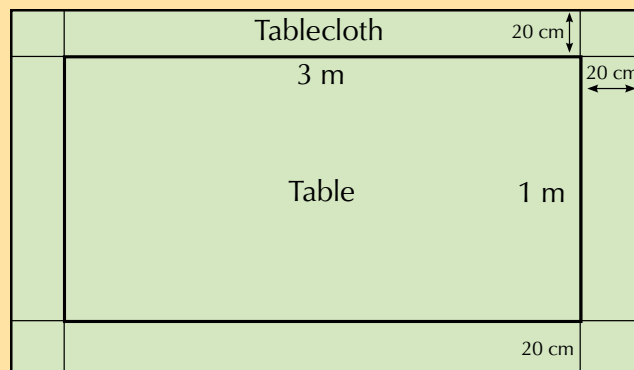
1. Mr. Madikiza has just finished building a new house. He measured the distance around his yard and found it to be 90 m.

   a) Fencing material is sold at R 95,20 per metre. How much is the fencing material going to cost him?
   b) Suppose he has to put a pole after every 1,5 m. How many poles will he have to buy?

c) If the fencing poles cost R 65 each, calculate the total costs of the poles alone.

d) Calculate the total cost of fencing the yard.

2. Jenny has started a decorating business and has a contract to provide decor at a wedding reception.

a) The tables used at this wedding are rectangular with a length of 3 m and a width of 1 m. The fabric she plans to use for the tablecloth costs R 75 per metre (but can be bought in lengths smaller than a metre) and is sold in rolls that are 1,4 m wide. The bride and groom want the tablecloths to hang at least 20 cm over the edges of the tables. Calculate the cost of the cloth for each table.

b) If there are 15 tables at the wedding, calculate how much she is going to spend on tablecloths alone.

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1. 24H6 2. 24H7

5.3 Measuring mass or weight EMG4J

The scientific word for how much an object weighs on a scale is "mass". In this book we will use the words "weight" and "mass" interchangeably, because both are used in everyday language. For example "I weigh 60 kg" or "the car's mass is 1 tonne".

In many contexts, we use scales to measure weight or mass. Different types of scales are used to measure different sizes of objects. Some examples are given in the table below:

	Kitchen scales can be used to measure small quantities of food usually up to 2 or 3 kg. The scale on the left can measure weight between 0 and 2 kg in weight. The units are divided into kilograms and grams.
	Scales for measuring larger quantities of food (like vegetables or fruit) are sometimes seen in shops or at markets. The scale on the left can measure weight from 0 to 10 kg.
	Bathroom scales can be analog or digital (like the scale on the left). They are used to measure a person's weight, and can measure weight from 0 to 150 kg. Bathroom scales usually show units in kilograms and grams - e.g. 63,6 kg.
	Clinics and doctors' practices often use larger analog scales to measure a person's weight. These can also measure weight between 0 and 150 kg.

	Flat electronic scales, called platform scales, can be used to measure bulky objects like suitcases (at the airport) or dogs (at the vet).
	Weighbridges are used to measure very large objects like trucks. The truck drives onto a special strip of road that is connected to a digital scale. The scale operator (shown in the picture on the left) then reads off the truck's weight in tonnes.

DEFINITION: *Analogue scale*

A scale that has no electronic devices attached to it, (e.g. LCD screens).

DEFINITION: *Digital scale*

A scale that has electronic devices on it like digital and LCD screens.

DEFINITION: *Calibration*

This is process by which a scale is set in order to take accurate readings.

Most analogue scales can become inaccurate when they are moved around, because they have moving parts inside that can shift if the scale is bumped or dropped. Therefore, before we use an analogue scale we has to adjust the scale to make sure that it gives the most accurate readings possible. This process of adjusting the scales again is called re-calibration.

Digital scales are calibrated (adjusted for accuracy) in the factory when they are made and do not become inaccurate when they are moved. Other, larger scales like a weighbridge will be calibrated on-site (usually by a professional engineer or technician).

Worked example 3: Measuring weight

QUESTION

Study the following pictures of food on a scale and answer the questions that follow:

1.

a) How much does this rice weigh in grams?

b) Convert this to kilograms.

2.

a) How much does this flour weigh in kilograms?

b) Convert this to grams.

3.

a) How much do these sweet potatoes weigh in grams?

b) Convert this to kg.

4. What is the maximum weight that the scale used for the above three questions can measure?

SOLUTION

1. a) 600 g

   b) 600 g ÷ 1000 = 0,6 kg

2. a) 1 kg

   b) 1 kg × 1000 = 1000 g

3. a) 300 g

   b) 300 ÷ 1000 = 0,3 kg

4. 3 kg.

Activity 5 – 2: Calculating weight

1. A lift in a shopping mall has a notice that indicates that it can carry 2,2 tonnes or a maximum of 20 people. Convert the tonne measurement to kilograms and work out what the engineer who built the lift estimated the maximum weight of a person to be.
2. A long distance bus seats 50 passengers and allows every passenger to each have luggage of up to 30 kg.

a) If 50 people, with average weight of 80 kg per person, and one piece of luggage each that weighs an average of 29 kg, what would be the total load being carried by the bus in tonnes?

b) If the bus weighs 4 tonnes, how much does it weigh in total (in kg) including all the passengers and the luggage?

3. John applied for a job as a flight attendant but was told that he had to lose at least 5 kg before he met their maximum weight allowance (so that the plane - full of passengers, luggage and fuel - is not too heavy) and could reapply.

   a) If John weighed 85 kg at the time he applied for the job, what is the maximum weight that he can weigh in order to re-apply for the job?

   b) John weighs 78 kg when he weighs himself after six months. Do you think he can reapply for the job? Explain your answer.

4. Sweet Jam can be bought in bulk from a warehouse in boxes of 25 tins each.

   a) Suppose that a trader buys a box of 250 g Sweet Jam tins for resale. Calculate the total weight of the tins in the box, in kg.

   b) If he orders 15 boxes of Sweet Jam, calculate the total weight of his order in kg.

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1. 24H8 2. 24H9 3. 24HB 4. 24HC

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Worked example 4: Personal weight and health

QUESTION

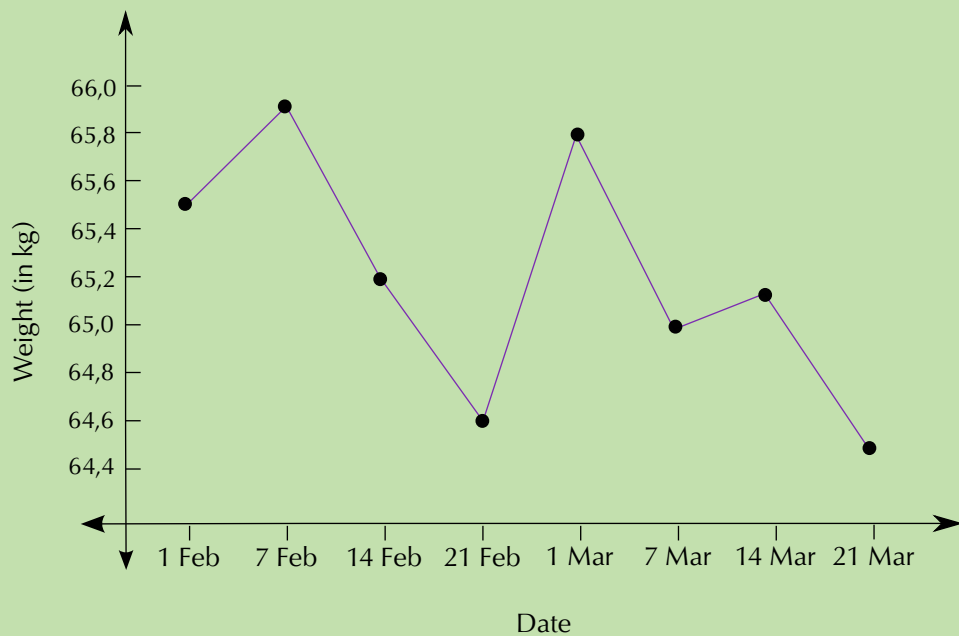
Annabelle weighs herself once a week (at the same time of day, wearing similar clothes) for two months and records the following measurements:

Date	1 Feb	7 Feb	14 Feb	21 Feb	1 Mar	7 Mar	14 Mar	21 Mar
Weight (kg)	65,5	65,9	65,2	64,6	65,8	65,0	65,1	64,5

1. What is the difference (in kg) between her weight on 1 Feb and 21 March?
2. By how much did her weight increase between 21 Feb and 1 March?
3. Give two possible explanations for why her weight went up suddenly on 1 March.
4. Plot a graph showing Annabelle's weight changes per week (you should have dates on the horizontal axis and kilograms on the vertical axis).

SOLUTION

1. 65,5 kg - 64,3 kg = 0,8 kg. She weighs 0,8 kg less on the 21st March.
2. By 1,6 kg.
3. Either she ate a lot of food in the week between 21 Feb and 1 March (which is unlikely - it is difficult to gain 1,6 kg of weight in one week!), or she did not check that the scale was set to "0 kg" before she weighed herself.

4.

Activity 5 – 3: Monitor your weight at home

If you have a bathroom scale at home, monitor your weight every day for a week. Whilst you should weigh yourself at the same time and in the same kinds of clothes everyday to get consistent results, you may experiment with your measurements: for example, do you weigh more with your shoes on? Or do you weigh more before or after a meal? Don't forget to check that your scale is correctly calibrated before you take each measurement.

1. What is the difference between your weight on Day 1 and Day 7, if any?
2. Plot a graph showing your weight measurements.
3. Are there any measurements that are unexpectedly low or high? If so, give reasons why you think this may be. (Hint: your weight shouldn't fluctuate much in a week but factors like how much water you've had to drink or how much you've had to eat can influence the measurements!)

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1. 24HD 2. 24HF 3. 24HG

Activity 5 – 4: Calculating whether or not your school bag is too heavy

Read the following statements and complete the activities that follow:

According to mysafetyandhealth.com, you should never carry more than 15% of your body weight. Elias weighs 66 kg and his backpack, with school books, weighs 12 kg. Elizabeth weighs 72 kg and her school bag, with school books, weighs 8 kg.

1. Determine 15% of Elias's weight.
2. Is his bag too heavy for him?
3. Determine 15% of Elizabeth's weight.
4. Is her bag too heavy for her?
5. Using a bathroom scale, weigh your school bag, with your school books inside it.
6. Weigh yourself.
7. Do the necessary calculations in order to write the weight of your school bag as a percentage of your own weight.
8. Is your school bag too heavy for you? Give a reason for your answer.

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1. 24HH 2. 24HJ 3. 24HK 4. 24HM 5. 24HN 6. 24HP
7. 24HQ 8. 24HR

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Worked example 5: Calculating cost from weight

QUESTION

Khuthele School has two soccer fields. The grass need to be covered with fertiliser. A bag of 30 kg of fertiliser costs R 42,60. The school will need to buy 96 bags. How much will they pay for the fertiliser? How many kg will they buy altogether?

SOLUTION

Number of bags × price: 96 × R 42,60 = R 4089,60

Number of bags × weight of one bag: 96 × 30 kg = 2880 kg

Worked example 6: Calculating cost from weight

QUESTION

Mr. Booysens needs to buy sand to build a new room onto his house. Sand is sold for R 23 per kg. Suppose Mr. Booysens needs to buy 0,8 tonnes of sand in order to build the room.

1. Write the amount of sand needed in kg.
2. Calculate the total amount of money he will have to spend to buy enough sand for the project.
3. If sand is only sold in 50 kg bags, how many bags will Mr Booysens need to buy?

SOLUTION

1. Remember that 1 tonne = 1000 kg
   so he needs 0,8 tonnes × 1000 kg = 800 kg
2. Quantity of sand needed × Cost per kg
   800 × 23 = R 18 400
3. 800 kg ÷ 50 kg = 40 bags of sand.

Activity 5 – 5: Measuring weight and calculating costs

A chef is preparing a meal that needs 3,75 kg of rice and 1,5 kg of beef. The recipe will feed 8 people.

1. Rice is sold in packets of 2 kg. How many packets will he need for this meal?
2. Suppose it costs R 31,50 per 2 kg pack. Calculate the total cost of rice he will need.
3. If beef costs R 41,75 per kg, calculate the total cost of beef needed for this meal.
4. Calculate the total cost of preparing the meal. (Assume that all the other ingredients are available for free).

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1. 24HS 2. 24HT 3. 24HV 4. 24HW

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5.4 Measuring volume EMG4K

Volume is a measurement of how much space an object takes up (e.g. 600 ml of water). Capacity is a measure of how much liquid a container can hold when its full. (e.g. a 2 litre bottle). For example, if you have a 500 ml bottle of cola, with 200 ml of cola left inside it, the capacity of the bottle is 500 ml, while the volume of cola inside it is 200 ml.

As with length and weight, we use different containers or instruments to measure the volume of different quantities of liquid or dry ingredients. Some examples are given in the table on the next page:

	Measuring spoons come in different standard sizes or capacities, including a teaspoon (5 ml) and a tablespoon (15 ml). Some sets of spoons also include $\frac{1}{2}$ and $\frac{1}{4}$ teaspoons.
	Measuring cups also come in standard capacities, including 1 cup (250 ml), $\frac{1}{2}$ a cup (125 ml) and $\frac{1}{4}$ cup (63 ml).
	Measuring jugs come in many different sizes, but the most common capacity is 1 litre. The measuring jug on the left gives measurements in litres and millilitres. It has a capacity of 1 ℓ.
	Flasks, like measuring jugs, come in different capacities. They usually don't come with any calibrated measurements, (just a capacity measurement) so the only way to know what the volume of liquid inside a flask is, is to pour it out into a measuring jug.
	The capacity of an average household bucket is 10 litres. Some buckets have litre markings on the inside that enable you to measure off a volume of liquid less than 10 litres. (This is only accurate to the nearest litre though!)
	The capacity of a wheelbarrow is usually about 170 litres.

As we learned in Chapter 3, it is possible to estimate the quantities of a substance that we need - for example heaped teaspoons. Another common way of estimating is using a fraction of a standard quantity, for example a quarter teaspoon of salt, or half a brick of butter.

Worked example 7: Measuring volume

QUESTION

1. An urn of boiling water in an office has a capacity of 20 litres.

   a) If it is filled to maximum capacity, calculate the number of 250 ml cups that can be shared from it.
   b) After everyone has their morning tea, there are only 6 litres of water left in the urn.
      i. How much water is this in ml?
      ii. How many 250 ml cups of water are left in the urn now?
      iii. What percentage of the urn still has water in it?

2. Jabu is building a new flower bed and is using a bucket to carry soil from another part of the garden to the new bed. He knows his bucket has a capacity of 10 ℓ.
   a) If he has 300 ℓ of soil that needs to be moved, and for each trip he fills the bucket to the top with soil, how many trips will Jabu have to make with the bucket to move all the soil?
   b) Jabu decides that 10 litres of soil is too heavy to carry. How many trips will he have to make to move all the soil if he only fills the bucket with 7 litres of soil at a time?
   c) Jabu's friend Matthew arrives with his wheelbarrow and a spade. He suggests that Jabu should rather move the soil using the wheelbarrow. If the wheelbarrow has a capacity of 150 litres and they fill it to the brim, how many trips will Jabu have to make to move all the soil?

3. Dorothy goes hiking with her friends every Sunday morning. She always takes a flask of tea. She knows that the lid of the flask (which doubles as a cup) can hold 200 ml of water. If she can get five and a half cups of tea out of the flask, calculate the capacity of the flask, in litres.

SOLUTION

1. a) 20 litres = 20 000 ml
   20 000 ml ÷ 250 ml = 80
   Eighty 250 ml cups can be poured from the urn.

   b) i. 6 ℓ = 6000 ml
      ii. 6000 ml ÷ 250 ml = 24
      There are 24 cups of water left in the urn.
      iii. $\frac{6\,\ell}{20\,\ell} \times 100 = 30\%$
      The urn is 30% full.

2. a) 300 ℓ ÷ 10 ℓ = 30 trips.

   b) 300 ℓ ÷ 7 ℓ = 42,8. Jabu can't make 0,8 of a trip so we round this up to 43 trips (even though the bucket won't have 7 litres of soil in it for the last trip).

   c) 300 ℓ ÷ 150 ℓ = 2 trips.

3. 200 ml × 5,5 cups = 1100 ml = 1,1 ℓ.
   The capacity of her flask is 1,1 litres.

Activity 5 – 6: Measuring and comparing volume

1. A six pack of soft drinks contains 6 cans of 330 ml each. What is the total volume of soft drink in a six pack? Give your answer in litres.

2. A large juice container has a capacity of 30 litres.

   a) If the container is 75% full, calculate the amount of juice in the container in litres.

   b) How many 300 ml cups of juice can you fill (to the top)?

3. Jonathan uses the following recipe to make chocolate muffins:
   $\frac{2}{3}$ cup of baking cocoa
   2 large eggs
   2 cups of flour
   $\frac{1}{2}$ cup of sugar
   2 teaspoons of baking soda
   $1\frac{1}{3}$ cups of milk
   $\frac{1}{3}$ cup of sunflower oil
   1 teaspoon of vanilla essence
   $\frac{1}{2}$ teaspoon of salt

   a) If 1 teaspoon = 5 ml, calculate how much baking soda Jonathan will use. Give your answer in ml.

   b) Calculate the amount of vanilla essence Jonathan will use in this recipe. Give your answer in ml.

c) Jonathan does not own measuring cups but he does own a measuring jug calibrated in ml. How many ml of flour does he need? (1 cup = 250 ml).

d) If Jonathan buys a 100 ml bottle of vanilla essence, how many times will he be able to use the same bottle, if he bakes the same amount of muffins each time?

e) The recipe above is used to make 30 muffins. Calculate how many cups of flour Jonathan will need to make 45 muffins.

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1. 24HX 2. 24HY 3. 24HZ

Worked example 8: Calculating costs

QUESTION

1. Suppose paraffin is sold at R 7,80 per litre at the local service station.

   a) How much will you pay for 5 litres of paraffin?

   b) How many litres of paraffin will you be able to buy for R 20? Round off your answer to two decimal places.

   c) If you have a paraffin lamp at home that can hold 500 ml of paraffin, how many times will you be able to refill the lamp if you buy 3 litres of paraffin?

2. If petrol costs R 11,72 a litre:

   a) Calculate how much it costs to fill up a car that has a tank of 50 litres.

   b) Calculate how many litres you could buy with R 200. Round off your answers to two decimal places.

SOLUTION

1. a) Number of litres $\times$ Cost per litre
   $= 5$ litres $\times$ R 7,80 $=$ R 39

   b) Amount of money $\div$ Cost per litre
   $=$ R 20 $\div$ R 7,80 $= 2{,}56410256\ldots$
   $\approx 2{,}56$ litres (to two decimal places)

   c) 3 litres $= 3000$ ml
   3000 ml $\div$ 500 ml $= 6$
   You would be able to refill the lamp 6 times.

2. a) Number of litres $\times$ Cost per litre
   $= 50$ litres $\times$ R 10,72 $=$ R 536

   b) Amount of money $\div$ Cost per litre
   $=$ R 200 $\div$ R 10,72 $= 18{,}6567164\ldots$
   $\approx 18{,}66$ litres (to two decimal places)

Activity 5 – 7: Measuring volume and calculating costs

1. Thandi is baking cupcakes and the recipe she has requires $1\frac{1}{3}$ cups of milk.

   a) Calculate how many ml of milk she will need if 1 cup $= 250$ ml.

   b) If the recipe is designed to produce 20 cupcakes, calculate the amount of milk required to bake 30 cupcakes. Give your answer in litres.

   c) Milk is sold in bottles of 1 litre each for R 8,50 at the local store. Calculate the amount of money Thandi will need to spend on milk to make the 30 cupcakes.

2. Thabiso decides to sell homemade lemonade. He has made 5 litres of lemonade to sell at the local schools' rugby tournament.

   a) Thabiso will be selling his lemonade in 250 ml plastic cups. Calculate the number of cups of lemonade he will be able to sell.

b) If he sells the lemonade at R 5 per cup, how much money will he make from the lemonade? (Assume that he sold all of his lemonade).

c) If it cost Thabiso R 120 to make the lemonade, how many cups would he need to sell (at R 5 each) before he's made back the money he spent?

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1. 24J2 2. 24J3

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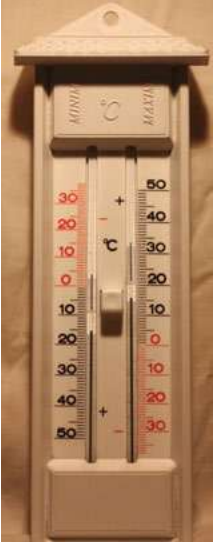
5.5 Measuring and monitoring temperature EMG4M

Temperature is involved in many aspects of our daily lives, including our own bodies and health; the weather and how warmly we must dress; and how hot the stove or oven must be in order to cook food.

Temperature can be negative or positive. The higher the positive temperature, the hotter it is. The lower the negative temperature, the colder it is.

Temperature is measured in degrees Celsius (°C). Water freezes and becomes ice at 0°C and at sea level, it boils at 100°C. A normal temperature for a healthy person is between 36°C and 37°C.

As with length, weight and volume, we use different instruments to measure temperature in different circumstances:

	An analogue thermometer is a thermometer that has no electronic parts fixed to it. The most common analogue thermometers are those used to measure your temperature when you're sick. They can usually measure temperature from about 32 - 42 degrees Celsius. (Anything lower or higher than that means you're extremely ill!) You can also get digital thermometers to measure human temperature.
	An outdoor thermometer is a thermometer that is used to measure temperature outside. Some outdoor thermometers measure maximum and minimum temperature at the same time. The thermometer on the left measures the minimum temperature on the left hand side and the maximum temperature on the right. Both sides of the thermometer have mercury in them that expands when the temperature changes. A small blue bar indicates the highest/lowest temperature recorded since the thermometer was reset (by pushing the button in the middle). The mercury level shows the current temperature.
 	A stove dial does not give exact, accurate temperature but rather shows relative temperature settings. It has different heat levels (usually 1 - 6, coolest - hottest) for different cooking temperatures.
 	The oven temperature dial shows the actual temperature setting, not relative temperature. The numbers around the dial are in degrees Celsius.
 	A weather report may be a map, table or list, showing minimum and maximum temperature for a region or for the entire country. Weather reports usually also contain information about rain forecasts and cloud cover.

Worked example 9: Measuring temperature

QUESTION

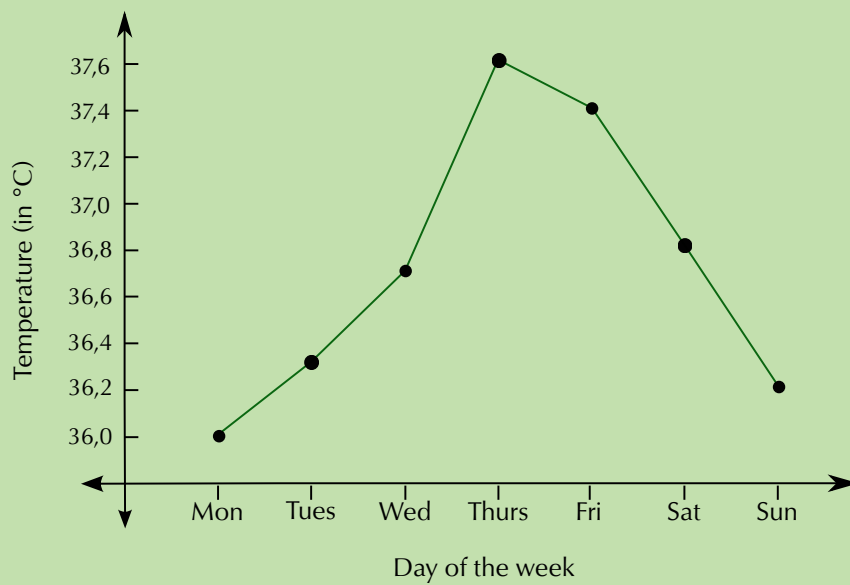
Natalia feels like she is getting sick, and decides to measure her body temperature using a thermometer, once a day for a week to see if she is developing a fever. She knows that if her temperature rises above 37,5°C, she needs to see a doctor because this means she has an infection. Natalia records the following values:

Day	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Temperature (°C)	36,0	36,3	36,7	37,6	37,4	36,8	36,2

1. a) What is the lowest temperature she records?
   b) What is the highest temperature she records?
   c) What is the difference between these two temperatures?
2. a) Do you think Natalia should have seen a doctor? Give reasons for your answer.
   b) On what day was she the most ill?
   c) Do you think she was getting better by end of the week? Explain.
3. Draw a line graph plotting the information in the table.

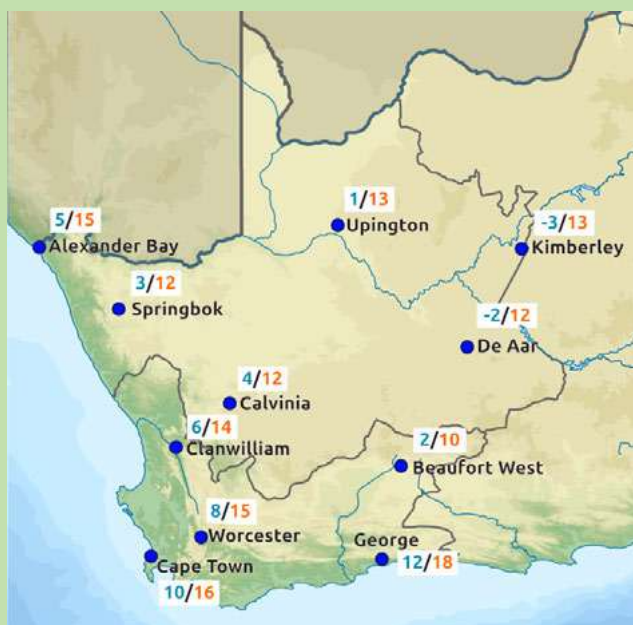
SOLUTION

1. a) 36,0°C
   b) 37,6°C
   c) 37,6°C – 37,6°C = 1,6°C
2. a) Based on temperature alone, yes - her temperature on the Thursday was abnormally high. However, it started falling the next day. If it had remained at 37,6°C or gotten higher, then she should definitely have gone to see the doctor.
   b) Thursday - her temperature was highest.
   c) Yes - her temperature was almost back to normal.

3.

Worked example 10: Reading a weather report

QUESTION

The following weather report appears in the local newspaper in George, in the Western Cape. It gives the expected temperatures for one day in winter.

Study it and answer the questions that follow:

1. For which two South African provinces does this weather map show temperatures?
2. Explain why there are two temperatures given next to each town.
3. Which is the coldest town?
4. Which is the warmest town?
5. What is the difference between the two temperatures given for Alexander Bay?
6. What is the difference between the two temperatures given for De Aar?
7. Based on your own experience, at what time of day is it usually the coldest? (I.e. at what time of day is the minimum temperature likely to be reached?)
8. Harry is planning to drive from Cape Town to Beaufort West on the day for which these temperatures are forecast. Should he pack warm clothes? Explain your answer.

SOLUTION

1. The Western and Northern Cape
2. The first temperature is the expected minimum temperature and the second one is the expected maximum temperature.
3. Kimberley.
4. George.
5. $15°C - 5°C = 10°C$
6. $12°C - (-2°C) = 12 + 2 = 14°C$
7. It is usually the coldest late at night or very early in the morning - this is when the minimum temperature will occur.
8. Yes. Beaufort West is significantly colder than Cape Town, so Harry should pack warm clothes.

Activity 5 – 8: Understanding temperature

1. Katie is going to bake fish and potatoes for dinner. On the box of frozen fish, the instructions say "Cook for 20 min at 200°C". Her recipe for baked potatoes needs the oven temperature to be 120°C. What is the temperature difference between these two temperatures?

2. Bheki lives in Durban. He knows that at sea level, water boils at 100°C. He is trying to boil water in a kettle on the stove. If the water is 72°C, how much hotter does it need to be (in °C) before it will start boiling?
3. Marie wants to make ice cubes. She knows that water freezes at 0°C. She measures the temperature of the water in the ice tray to be 23°C. How much colder (in °C) does the water have to be before it will freeze?
4. Thembile lives in Sutherland (the coldest town in South Africa) and records the following minimum temperatures, (in degrees Celsius), during winter:
   $3; -5; 6; 8; -2; 4; 1; 0; 7$
   a) Arrange these temperatures from coldest to warmest.
   b) What is the difference between the coldest and warmest temperature he recorded?

Figure 5.1: SALT Telescope, Sutherland

5. Aparna lives in Polokwane. She finds the following weather forecast for her city in the newspaper:

Day	Wed	Thurs	Fri	Sat	Sun
Max Temp	23	26	29	25	26
Min Temp	15	16	22	20	18

   a) What day is supposed to be the hottest?
   b) On this hottest day, what will the difference between the maximum and minimum temperature be?
   c) What is the difference between the minimum temperature on Wednesday and the minimum temperature on Sunday?
   d) Draw a graph of the maximum temperatures.
   e) On a separate set of axes, draw a graph of the minimum temperatures.
   f) Do these two graphs have the same shape? Answer yes or no.

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1. 24J4 2. 24J5 3. 24J6 4. 24J7 5. 24J8

5.6 End of chapter activity EMG4N

Activity 5 – 9: End of chapter activity

The Grade 10 class at Masibambane High School are organising a tea party for the residents of a nearby old age home.

1. Some of the class members are going to bake cake, using the following recipe:

   1 cup butter
   1 cup sugar
   1 teaspoon vanilla essence
   1 teaspoon lemon extract
   5 eggs
   2 cups flour
   1 teaspoon baking powder
   2 egg whites for icing

   a) The learners know that this recipe will make one cake, and that one cake yields 8 slices. If there will be 60 people at the tea party, and everyone has only one slice of cake, how many cakes do they need to make?
   b) The learners decide to bake 9 cakes, so that there will be more than enough cake to go around.
      i. How many cups of butter will they need?
      ii. How many litres of flour will they need? (1 cup = 250 ml).
      iii. How many ml of vanilla essence will the learners need for 9 cakes? (1 tsp = 5 ml).
      iv. If vanilla essence is sold in 25 ml bottles, how many bottles will the learners need to buy?
      v. If vanilla essence costs R 7,85 a bottle, how much will the required vanilla essence for 9 cakes cost?
      vi. How many eggs will the learners need for 9 cakes?
      vii. If eggs are sold in boxes of 6, how many boxes will they need to buy and how many eggs will be left over?
      viii. If one box of eggs costs R 8,40, how much will enough eggs for 9 cakes cost?
   c) The cakes are baked in square cake tins. If the width of one cake is 200 mm, how wide will 6 cakes packed side by side be? (Give your answer in cm).

d) If one cake weighs 700 g, and there are 8 slices per cake, calculate how much one slice will weigh.

e) The cake needs to be baked in the oven for 40 minutes at 180°C. According to the oven's temperature dial, the temperature in the oven is 200°C.

  i. By how much must the oven cool before the cake can be baked?

  ii. What do you think will happen if they leave the oven temperature at 200°C and bake the cake at this higher temperature?

2. Other learners in the class are going to make fruit juice for the tea party.

   a) They estimate that each person will have 600 ml of juice. How many **litres** of juice will they need to make in total (for 60 people)?

   b) The class makes 40 litres of juice. They wish to transport it in 1,5 ℓ flasks.

      i. How many flasks will they need?

      ii. If they only have 15 flasks, (and can transport 15 flasks at once from the school to the home) how many trips will they have to make to get all the fruit juice to the tea party?

3. The old age home has a kettle that can hold 1,7 litres of water.

   a) How many 200 ml cups of water can be poured from the kettle when it is full?

   b) What percentage of 1,7 litres is one 200 ml cup?

   c) Alison measures the temperature of the water in the kettle (with a thermometer) to be 65°C. She knows that the water will boil at 100°C. How much hotter (in °C) does the water need to be in order to boil?

4. The class decide they also want to buy bags of sweets for their tea party. If one 250 g bag of jelly beans costs R 5,49, calculate how much 3 kg of jelly beans will cost.

5. The learners estimate that each person will eat 300 g of biscuits.

   a) If there are 60 people attending the party, how many kg of biscuits should they buy?

   b) If biscuits are only sold in 500 g boxes, how many boxes will they need to buy?

   c) If one box of biscuits costs R 3,99, calculate how much the learners will have to spend to buy enough biscuits for everyone.

6. The Grade 10 class want to hang ribbons in the room where they are going to host their tea party. They want to cut the ribbons into 600 mm lengths.

a) If they buy 5 m of ribbon, how many whole pieces of 600 mm ribbon will they be able to cut?

b) If the ribbon costs R 6,99 per metre, how much will the ribbon cost in total?

7. The class checks the weather report for the week in which the want to have the party:

Day	Mon	Tues	Wed	Thurs	Fri
Temperatures	15/17	14/19	18/23	19/26	17/20

a) If they want to have the tea party outside in the home's gardens, on which day should the plan to do it? Give reasons for your answer.

b) What is the lowest temperature predicted for the week?

c) What is the highest temperature predicted for the week?

d) What is the difference between the minimum and maximum temperatures forecast for the Tuesday?

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1. 24J9 2. 24JB 3. 24JC 4. 24JD 5. 24JF 6. 24JG
7. 24JH

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CHAPTER

Scale, maps and plans

6.1 Introduction and key concepts EMG4P

In this chapter we will learn how to work with scale, maps and seating plans. Maps and plans are visual representations of the real world around us - for example a school, a town, a movie theatre or a shopping centre. They are tools that can help us find our way around a new environment, or find a particular place, like one shop in a shopping centre or your seat in a sports stadium.

In this chapter we will learn how to:

- use the number scale and the bar scale, and understand the advantages and disadvantages of both and what happens when we resize maps.
- estimate actual distance or length when given a scale map and calculate scaled measurements when given the actual distance or length.
- read maps and seating plans in order to describe the position of an object in relation to surrounding objects.
- find locations and follow and develop directions for travelling between two or more locations.

DEFINITION: *Scale*

The scale of a map is a ratio of the distance on the map to the actual distance on the ground or in real life. for example, a number scale of 1 : 100 means that 1 unit on the map represents 100 units on the ground or in reality (so 1 cm on the map = 100 cm = 1 m on the ground).

6.2 Number and bar scales EMG4Q

Introduction to number and bar scales EMG4R

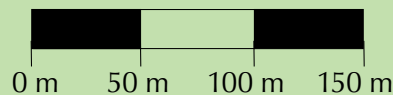
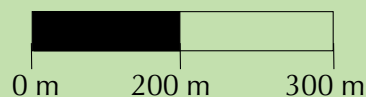
The two kinds of scale we will be working with in this chapter are the number scale and the bar scale. The **number scale** is expressed as a ratio like 1 : 50. This simply means that 1 unit on the map represents 50 units on the ground. So 1 cm on the map will represent 50 cm on the ground, or 1 m on the map will represent 50 m on the ground. To use the number scale, you need to measure a distance on a map using your ruler, and then multiply that measurement by the "real" part of the scale ratio (50) given on the map, in order to get the real distance.

The **bar scale** is represented like this:

Each piece or segment of the bar represents a given distance, as labelled underneath. To use the bar scale, you need to measure how long one segment of the bar is on your ruler. You must then measure the distance on the map in centimetres; calculate how many segments of the bar graph it works out to be (the total distance measured; divided by the length of one segment); and then multiply it by the scale underneath. So, if 1 cm on the bar represents 10 m on ground, and the distance you measure on the map is 3 cm (3 cm $\div$ 1 cm length of segment $=$ 3 segments) then the real distance on the ground is 3×10 m $=$ 30 m.

Worked example 1: Using the bar and number scales

QUESTION

1. You are given a map with the number scale of 1 : 40. You measure a length (on the map) of 10 cm. What is this distance in real life?
2. You are given a map with the number scale of 1 : 500. You measure a distance on the map of 15 cm with your ruler. What is this distance in real life?
3. You are given the following bar scale:

   You measure the distance on the map to be 15 cm. What is the actual distance?
4. You are given the following bar scale:

   You measure the distance between two points on the map to be 11 cm. What is the distance on the ground?

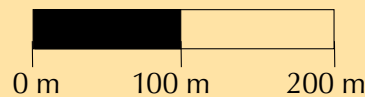
SOLUTION

1. Scale is 1 : 40.
   10 cm $\times$ 40 $=$ 400 cm $=$ 4 m
   The distance on the ground (in real life) is 4 m.
2. Scale is 1 : 500
   Therefore actual distance is 15 cm $\times$ 500 $=$ 7500 cm $=$ 75 m.
3. 1 segment $=$ 1,5 cm long, and represents 50 m.
   15 cm $\div$ 1,5 cm (length of segment) $=$ 10 so you have measured 10 segments in total.
   10 segments $=$ 10 $\times$ 50 m $=$ 750 m
4. 1 segment $=$ 2 cm long and represents 200 m. 11 cm $\div$ 2 cm (length of segment) $=$ 5,5, so you have measured 5,5 segments in total.
   5,5 segments $=$ 5,5 $\times$ 200 m $=$ 1100 m $=$ 1,1 km.

Activity 6 – 1: Using the bar and number scales

1. You measure the distance between two building on a map to be of 5 cm. If the map has a number scale of 1: 100, what is the actual distance on the ground?
2. You are given a map with the number scale 1 : 20. you measure a distance of 12 cm on the map. What is the actual distance in real life?
3. You measure a distance of 10 cm on a map with the following bar scale:

(1 cm = 15 m). What is the actual distance on the ground?

4. You measure a distance of 15 cm on a map with the following bar scale:

(2 cm : 100 m) What is the actual distance on the ground?

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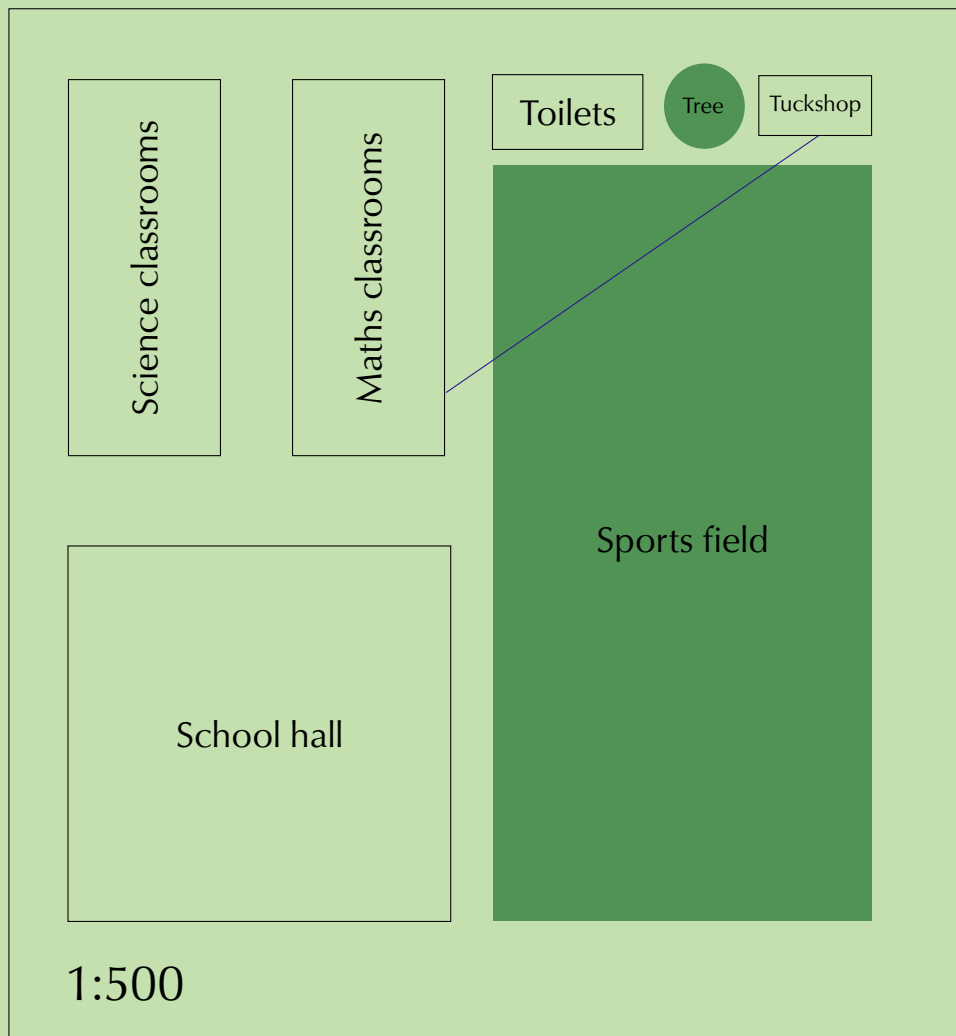
1. 24JJ 2. 24JK 3. 24JM 4. 24JN

Using number and bar scales to measure distance EMG4S

In the previous section about number and bar scales we only looked at how to calculate the actual length of an object or distance between two places when we know the length we measured on the map, and the scale used. However, number and bar scales are usually seen on maps and plans. In this section, we will learn how to measure the dimensions of objects and distance on scale maps and then how to use the number and bar scale to calculate the actual (real world) dimensions of those objects (like furniture and buildings).

Worked example 2: Using the number scale to estimate distance

QUESTION

Study the school map given below and answer the questions that follow:

1. Calculate the following real dimensions of the sports field in metres:
   a) length.
   b) width.
2. Calculate the length of the science classroom block in metres.
3. Zuki walks from the tuckshop to his maths classroom, along the blue dotted line shown. Measure how far he walked in metres.

SOLUTION

1. a) Use your ruler to measure the width of the sports field on the map. It is 5 cm wide.
   Now use the number scale 1 : 500 to determine the actual width of the field:

5 cm × 500 = 2500 cm
(**multiply** your scaled measurement by the "real" number in the scale ratio)
2500 cm ÷ 100 = 25 m
The field is 25 m wide

b) On the map, the field is 10 cm long.
10 × 500 = 5000 cm
5000 cm ÷ 100 = 50 m
The field is 50 m long

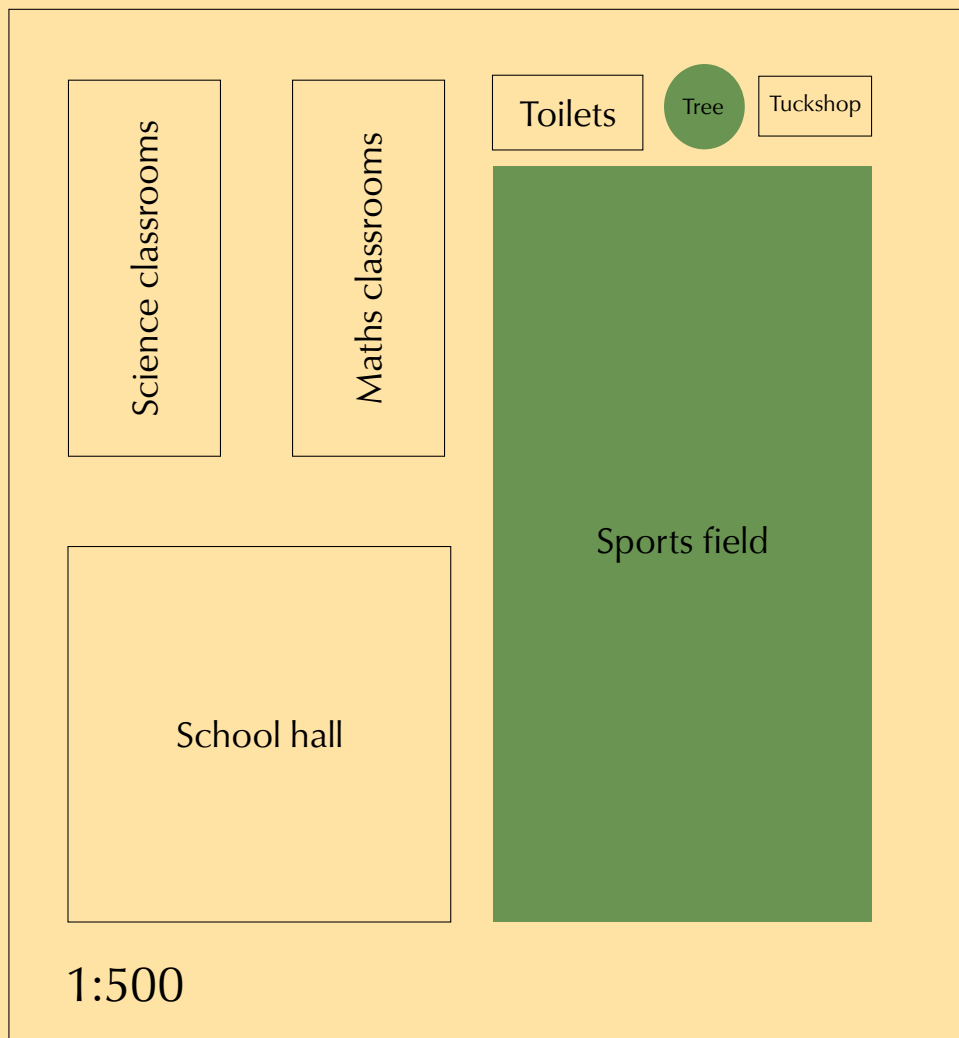
2. On the map, the science classroom building is 5 cm long.
5 cm × 500 = 2500 cm
2500 cm ÷ 100 = 25 m
The science classrooms are 25 m long

3. The blue dotted line is 6 cm long on the map.
6 × 500 = 3000 cm
3000 cm ÷ 1000 = 30 m
Zuki walked 30 m from the tuckshop to his maths classroom.

NOTE:
Although we say we are measuring distance on a map and calculating real distance, in reality we are approximating or estimating distance because the measurements you get using a scale and conversion are accurate only to the nearest metre or centimetre. For example, using the above measurement of how far Zuki walked from the tuckshop to his maths classroom, by our calculations he walked 30 m, whereas if we were to measure this distance exactly on the ground, using a measuring tape, he may actually have walked 30 m and 10 cm.

Activity 6 – 2: Using the number scale

Using the school map and scale given below, measure the drawings and then estimate the following real distances in metres:

1. the width and length of the school hall.
2. the width of the toilet block.
3. the distance between the science and maths buildings.

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1. 24JP 2. 24JQ 3. 24JR

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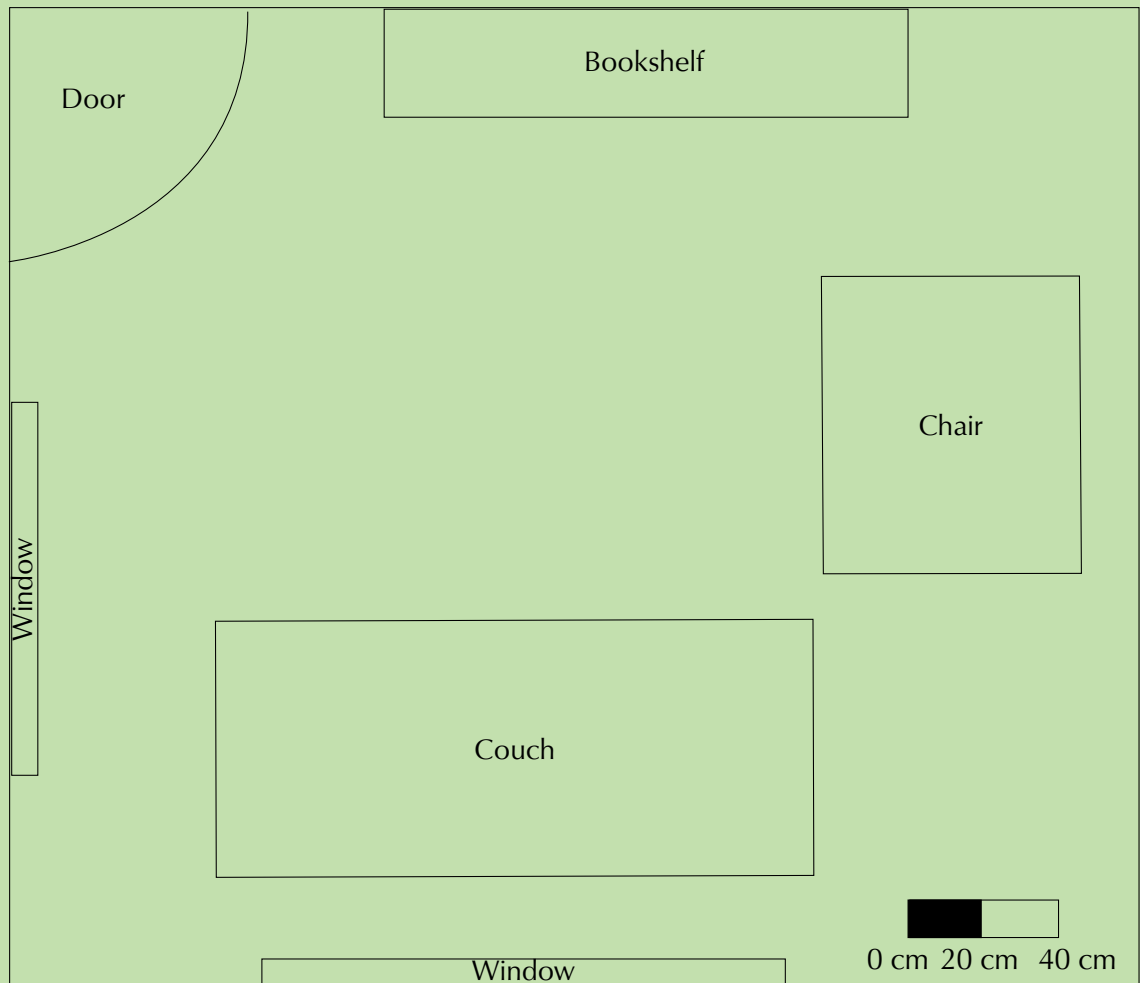
Worked example 3: Using the bar scale to estimate actual length

QUESTION

Study the map of the room given below and answer the questions that follow:

1. Using a ruler and a calculator, calculate the following real lengths in metres:

    a) the length of the room.

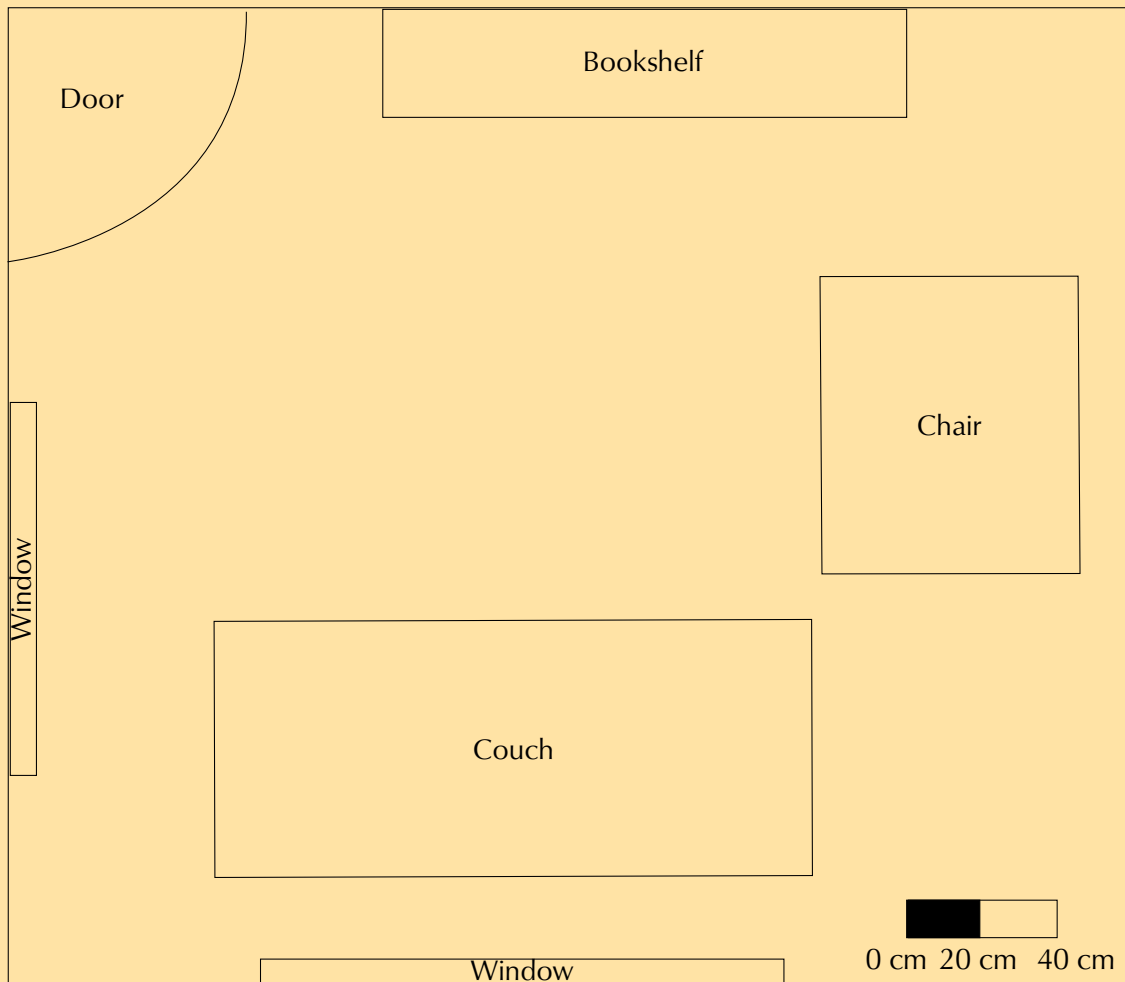
    b) the length of the couch.

SOLUTION

1. a) First measure the bar scale using your ruler.
    1 cm on your ruler represents 20 cm on the ground.
    Now measure the length of the couch.
    It is 15 cm long. 15 cm $\div$ 1 cm (length of segment) $=$ 15 segments,
    15 segments $\times$ 20 cm $=$ 300 cm $=$ 3 m.
    So the real length of the room is 3 m.

    b) 1 cm on your ruler represents 20 cm on the ground.
    On the map, the couch is 8 cm long. 8 cm $\div$ 1 cm (length of segment) $=$ 8 segments.
    8 segments $\times$ 20 $=$ 160 cm $=$ 1,6 m
    So the real length of the couch is 1,6 m.

Activity 6 – 3: Using the bar scale to estimate actual length

Using the diagram given below, calculate the real life dimensions for:

1. the length of the bookshelf.
2. the width and length of the chair.
3. the length of each of the windows.

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1. 24JS 2. 24JT 3. 24JV

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Understanding the advantages and disadvantages of each scale

EMG4S

By now you should understand how to use number and bar scales to measure real dimensions and distance on the ground when given a scale map. What happens if you resize a map though (for example you may want to make small photocopies of a map of your school, to hand out for an event taking place)? In the next example we will explore the effects on the number and bar scales when we resize maps.

Worked example 4: Resizing and accuracy

QUESTION

Diagram 1 Diagram 2 Diagram 3 Diagram 4

1. Measure the width of the school bag in Diagram 1 and use the scale to calculate the width of the school bag.
2. Measure the school bag in Diagram 2 and use the scale to calculate the width of the school bag.
3. What do you notice about the answers for 1. and 2.?

4. Measure the width of the school bag in Diagram 3 and use the scale to calculate the width of the school bag.
5. Measure the school bag in Diagram 4 and use the scale to calculate the width of the school bag.
6. What do you notice about the answers for 4. and 5.?
7. Write a sentence to explain what you have learnt as a result of your calculations.

SOLUTION

1. The measured width on the diagram is 3 cm. Therefore 3 cm × 15 = 45 cm. So the bag is 45 cm wide.
2. The measured width on the diagram is 5 cm. Therefore 5 cm × 15 = 75 cm. So the bag is now 75 cm wide!
3. These answers are very different. Which is correct? Is the bag 45 cm wide or 75 cm wide?
4. 1 segment = 1 cm long. The bag is 3 cm wide on the diagram, therefore 3 × 15 cm = 45 cm.
5. 1 segment = 1,5 cm long. The bag is 4,5 cm wide on the diagram. 4,5 ÷ 1,5 = 3 segments. 3 segments × 15 cm = 45 cm.
6. The answers for Questions 4 and 5 are the same!
7. When resizing scale diagrams using the number scale, we have to change the scale in order for it to remain accurate. (In the bigger diagram we would need to number scale to be 1 : 9 for the width of the bag to be 45 cm). When resizing diagrams using the bar scale, the length of the segments increases proportionally to the diagram, therefore the resized bar scale is also accurate and will give us the same answer.

If we resize a map that has a number scale on it, the number scale becomes incorrect. If a map is 10 cm wide when printed, and the number scale is 1 : 10 then 1 cm on the map represents 10 cm on the ground. However, if we reprint the map larger, and it is now 15 cm wide, our scale will still be 1 : 10 according to the map, but now 1,5 cm represents 10 cm on the ground (1,5 × 10 = 15 cm = width of map) so the answers to any scale calculations will now be wrong. When resizing maps that use the number scale, it is important to know that the scale changes with the map. This is a disadvantage to using the number scale.

If we resize a map that has a bar scale on it, the size of the bar scale will be resized with the map, and it will therefore remain accurate. This is an advantage to using the bar scale.

An advantage of the number scale is that we only have to measure one distance (we don't have to measure the length of one bar segment) and our calculations are usually fairly simple as a result. A disadvantage to using the bar scale is that we have to measure the length of one segment and measure the distance on the map, and our calculations can be more complicated because we have to calculate how many segments fit into the distance measured on the map.

Drawing a scaled map when given real dimensions EMG4V

We have learnt how to determine actual measurements when given a map and a scale. In this section we will look at the reverse process - how to determine scaled measurements when given actual dimensions, and draw an accurate two dimensional map. Remember that a scale drawing is exactly the same shape as the real (actual) object, just drawn smaller. In the next worked example we will look at how to draw a simple scaled map of a room.

In order to draw a map you need two pieces of information. Firstly you need to know the actual measurements of everything that has to go onto the map. Secondly you need to know what scale you have to use. The scale will depend on the original measurements, how much detail the map has to show and the size of the map. If you want to draw a map, or plan, of a room in your house on a sheet of A4 paper and include detail of the furniture you would not use a scale of 1: 10 000 (this scale means that 1 cm in real life is equal to 10 000 cm or 1 km in real life).

In Grade 10 the scale will be given to you.

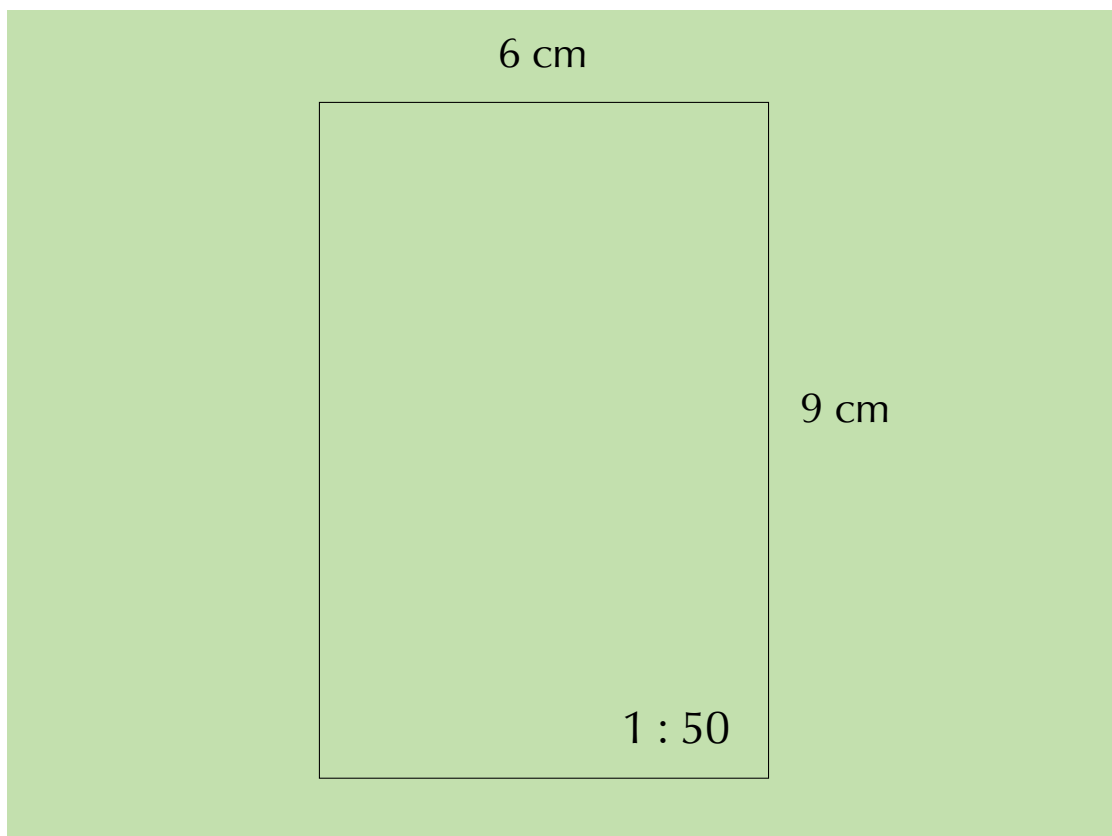
Worked example 5: Drawing scaled maps

QUESTION

Draw a scaled map of a room that has real dimensions 3 m by 4,5 m. Use a number scale of 1 : 50.

SOLUTION

The scale of 1: 50 means that 1 unit on your drawing will represent 50 units in real life so 1 cm on your drawing will represent 50 cm in real life.

- The width of the room is 3 m.
  - Convert 3 m to cm:
    $3 \text{ m} \times 100 = 300 \text{ cm}$
  - Use the scale to calculate the scaled width on the map:
    $300 \text{ cm} \div 50 \text{ cm} = 6 \text{ cm}$
    (**Divide** the actual, real measurement of the room by the 'real number' from the scale)
- The length of the room is 4,5 m.
  - Convert 4,5 m to cm:
    $4{,}5 \times 100 = 450 \text{ cm}$
  - Use the scale to calculate the scaled length on the map:
    $450 \text{ cm} \div 50 \text{ cm} = 9 \text{ cm}$
- The scaled measurements are 6 cm and 9 cm. We can now draw this on our plan. Don't forget to include the scale on your map!

Worked example 6: Drawing a scaled map

QUESTION

In this worked example we will add some furniture to the room in the previous example.

The room has the same dimensions (3 m $\times$ 4,5 m) and the scale to be used is still 1 : 50.

Draw the following items using the dimensions provided:

1. a couch 2 m $\times$ 1,2 m.
2. a window 2 m long.
3. a table 1,5 m wide and 2 m long.

You may arrange the furniture in the room in any way which you think is sensible.

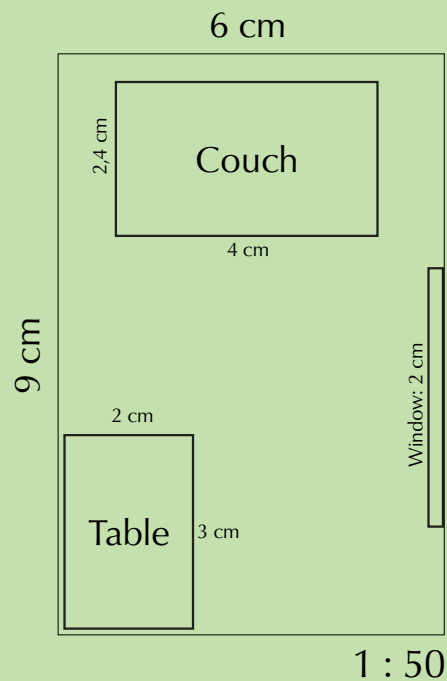
SOLUTION

The scale of 1: 50 means that 1 unit on your drawing will represent 50 units in real life so 1 cm on your drawing will represent 50 cm in real life.

The scaled dimensions of the room are the same as in the previous worked example: 6 cm $\times$ 9 cm.

1. The width of the couch is 1,2 m.
   1,2 m = 120 cm
   120 cm ÷ 50 = 2,4 cm
   The length of the couch is 2 m
   2 m = 200 cm
   200 ÷ 50 = 4 cm.
   So the scaled dimensions of the couch are 2,4 cm and 4 cm.

2. The length of the window is 2 m
   2 m = 200 cm
   200 ÷ 50 = 4 cm.
   So the scaled dimension for the length of the window is 2 cm.

3. The width of the table is 1 m.
   1 m = 100 cm
   100 cm ÷ 50 = 2 cm
   The length of the table is 1,5 m
   1,5 m = 150 cm
   150 ÷ 50 = 3 cm.
   So the scaled dimensions of the table are 2 cm and 3 cm.

Activity 6 – 4: Drawing a scaled map

1. The bedroom in the picture is 3,5 m by 4 m. It has a standard sized single bed of 92 cm by 188 cm. The bedside table is 400 mm square. Draw a floor plan to show the layout of the room. Use the number scale 1 : 50.

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1. 24JW

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Activity 6 – 5: Drawing scaled maps

1. Divide into groups in order to measure and draw an accurate, scaled floor plan of your classroom. Use a scale of 1 : 50. You will need to measure all the large objects (e.g. desks, windows, the blackboard) in the classroom, calculate what their scaled dimensions will be and then draw them carefully on your floor plan. Can you think of a different or better way to arrange the furniture in your classroom?

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1. 24JX

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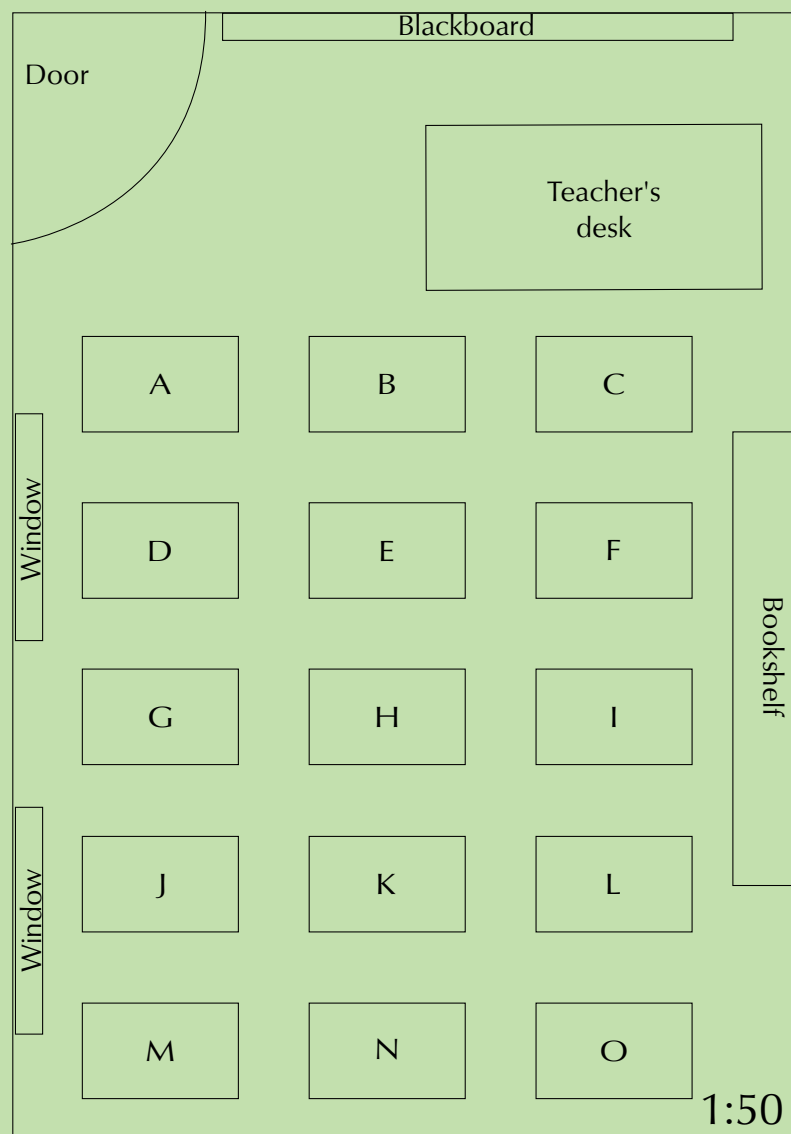
Knowing how to use scale maps is an important skill. It is also useful to know how to describe the position of an object (like a shop in a shopping centre, or classroom at your school) in relation to the objects around it.

For example, if you are at home and your friend is nearby and wants to visit you, you will need to give them instructions to get to your house, such as "turn left at the corner of Flower Street, walk straight down the road, pass the shop on your left, turn right into Yellow Street and my house is number 14, with the green gate".

In this section we will continue to work with the number and bar scales. We will also learn how to interpret and write simple directional instructions, and how to read seating and floor plans.

Worked example 7: Using the number scale and directional navigation on a classroom seating plan

QUESTION

Study the classroom plan below and answer the questions that follow:

1. How many learners are in this class if there is one learner at each desk?
2. Which learner is sitting to the left of learner K?
3. Which learners are sitting closest to the windows?
4. The scale of this plan is given as 1 : 50. Using your ruler and calculator, calculate:
   a) The width of the classroom (from the windows to the bookshelf).
   b) The length of the classroom (from the blackboard to the wall behind learners M, N and O).
   c) The width of the teacher's desk.
5. You sit at desk K. Explain how you would get from the door to your desk, using words like "left, right, in front of" and "behind".
6. Your friend forgets her bag in the classroom, and asks you to go and fetch it for her. She gives you the following directions: "Walk in through the door and turn right after the second row of desks. Walk past four rows of desks and look to your left, look over the desk next to you. My bag is on the floor." Where did she leave her bag?

SOLUTION

---

1. 15 learners.
2. Learner J.
3. Learners D, J and M.
4. a) On the seating plan, the classroom is 10,5 cm wide.
   $10{,}5 \text{ cm} \times 50 = 525 \text{ cm} = 5{,}25 \text{ m}$
   b) $15 \text{ cm} \times 50 = 750 \text{ cm} = 7{,}5 \text{ m}$
   c) $4{,}5 \text{ cm} \times 50 = 225 \text{ cm} = 2{,}25 \text{ m}$
5. Walk in through the door and turn right before desk B. Walk straight down the aisle passing desks E and H on the left. At desk K (behind desk H) turn around to face the blackboard and sit down in the seat.
6. Next to the bookshelf, or next to desk O.

Activity 6 – 6: Using the bar scale and directional navigation on a school ground plan

School hall

Toilets

Tuckshop

Tree

Maths classrooms (B)

B1 B2 B3

Science classrooms (A)

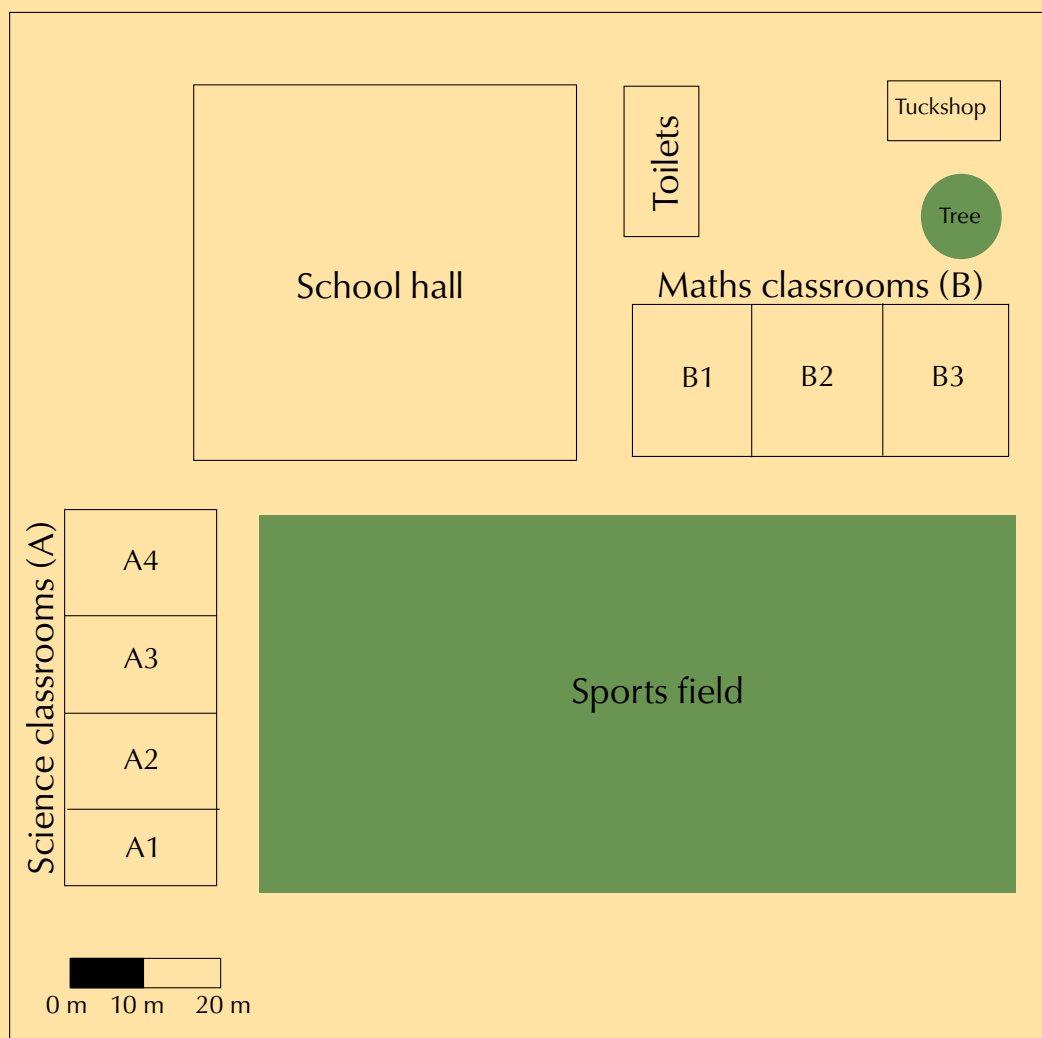
A4

A3

A2

A1

Sports field

0 m 10 m 20 m

1. Measure the width and length of the sports field in mm.
2. Use the bar scale to estimate the real (actual) width and length of the field in metres.
3. What subject would you be studying if you are in classroom A3?
4. What subject is taught in the classrooms that are next to the hall and face the sports fields?
5. Tebogo, a new learner, has started at your school. You are in the Science classroom, A1, when the break bell rings. Explain to Tebogo how to get to the tuckshop.

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1. 24JY 2. 24JZ 3. 24K2 4. 24K3 5. 24K4

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Worked example 8: Understanding a cinema seating plan

QUESTION

Study the cinema seating plan below and answer the questions that follow:

1. If you wanted to book seats for a movie, which seats would you want to sit in?
2. Are seats N 11 and N 12 available?
3. Which seats offer you and your classmates a best view and why?
4. You are going to the movies with a friend in a wheelchair. Name one seat where they can sit, and the seat next to it where you can sit with them?
5. Where will you sit if you want to have a front view of the screen?
6. What fraction of row N has been booked?
7. What percentage of the theatre is still available?

SOLUTION

1. For example: L8 and L9
2. No. They are booked.
3. Middle section because, it is not too close nor too far, from the screen
4. For example, friend could sit in the wheelchair seat next to D1, and you could sit in D1
5. Row A.
6. $\frac{5}{24}$
7. $211 \div 234 \times 100 = 90{,}17 \approx 90\%$

Activity 6 – 7: Understanding a stadium seating plan

Study the plan of a rugby stadium below, and answer the questions below:

1. Using words such as "near to" and "in the middle of", describe the position of a player standing at the point marked X.
2. Why do you think the seats are categorised?
3. Describe the position of the stand that contains the most Category 3 seats.
4. If your are standing at Point Y, what is the quickest way to get to the South Stand Ramp seating?
5. Describe the position of the hot dog stand at Point Z.
6. Your friend is at the hot dog stand (at Z). Explain to him how to find you if you are seated in a category 5 seat, Block A.
7. The width of the rugby field is 70 m the length 144 m. Draw a scale drawing of the rugby field using the number scale 1 : 1000.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24K5 2. 24K6 3. 24K7 4. 24K8 5. 24K9 6. 24KB
7. 24KC

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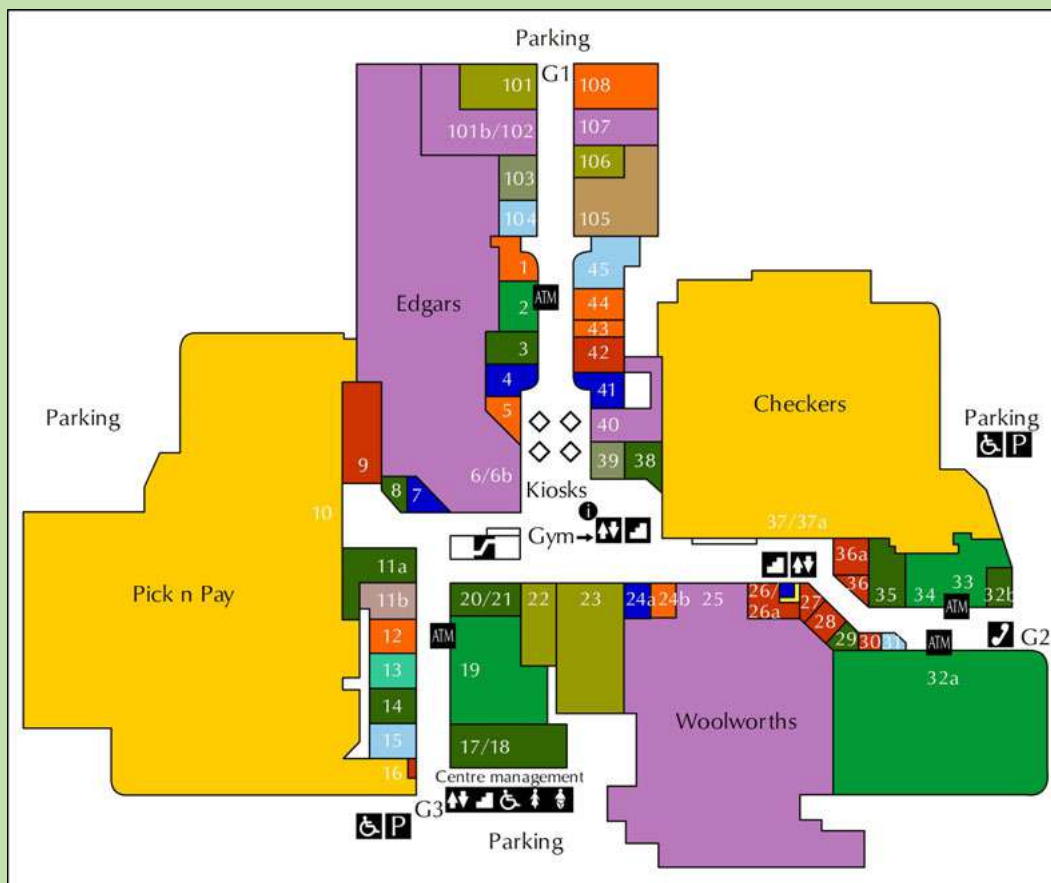
We will study floor plans and symbols in more detail in Chapter 10, but for the next worked example it is important to understand that symbols are often used on maps as a short-hand way of representing information. Some symbols that you may be familiar with are:

Worked example 9: Finding our way in a shopping mall

QUESTION

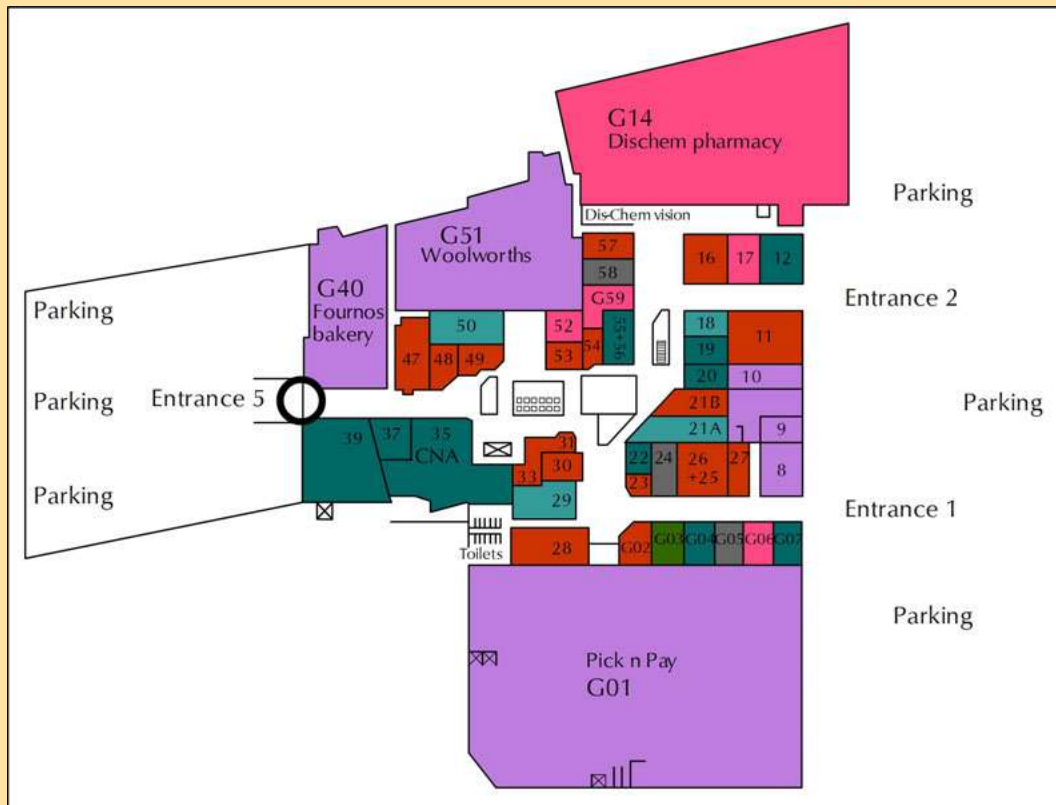
Study the map of the shopping centre below and answer the questions that follow:

1. Why do you think Checkers and Pick 'n Pay are the same colour?
2. Between which two shops would you find the escalator?
3. If you want to go to the gym which entrance would you use? Explain why.
4. Is the gym on the ground floor? Explain.
5. If you are the owner of a store, what number shop would you choose for your shop? Explain why.

6. Which entrance would you go to, to use a public phone?
7. UBy which entrances can disabled parking be found?
8. Give a possible reason for why this shopping centre has 4 ATM's.
9. Explain where the kiosks are situated.
10. You enter the shopping centre at entrance G3. You need to withdraw money from the ATM machine at shop number 32a. Give directions to explain how you would get there.

SOLUTION

1. Because they are the same kind of store - they are both large supermarkets.
2. Between Edgars and shop 20/21.
3. You could use entrance G3 because it is closest to the escalators and stairs to the gym.
4. No. The gym is on the upper level. The gym logo points to the symbols for lifts and stairs, showing that it is up one level.
5. There are many possible answers to this, but one example is Shop 11a. Shop 11a is next door to the entrance to Pick n Pay, so there should be lots of people walking past it every day on their way to Pick n Pay. In other words, lots of people would see your shop and what you were selling! For similar reasons, Shop 36a next ot Checkers would also be a good choice.
6. G2.
7. Disabled parking can be found in the parking lots outside G2 and and G3. There is no disabled parking outside G1.
8. Each ATM could be for a different bank - e.g. ABSA, FNB, Nedbank and Standard Bank.
9. The kiosks are situated in the middle of the mall between shops 5 and 39/40. They are near the main entrance to Edgars and the mall's information booth.
10. From entrance G3, go straight past shops 15, 14, 13 ,12. At shop 20/21, turn right before the escalators. Keep going straight past Woolworths, and past the stairs and elevators (on your left). Pass shops 27, 28, 29, 30, 31 on your right. The ATM in front of shop 32a will be on your right, just before the public phones and entrance G2.

Activity 6 – 8: Navigating a shopping mall

Study the map of the ground floor of a shopping centre and answer the questions that follow:

1. You want to go to Shop 37 to buy new shoes. What store will you find next to it?
2. What does "G51 Woolworths" mean on this map?
3. Do you think this shopping centre has more than one floor? Explain your answer.
4. Where should you park if you want to go to Fournos bakery and buy some fresh bread?
5. Name the two stores you could buy stationery from and describe how you would get to each of them from Entrance 1.
6. If you are at Entrance 2, explain how you would get to the toilets.
7. You are standing at the entrance of Dis-Chem. Your friend arrives at Entrance 5 and wants to meet you. Give your friend directions to explain where they will find you.

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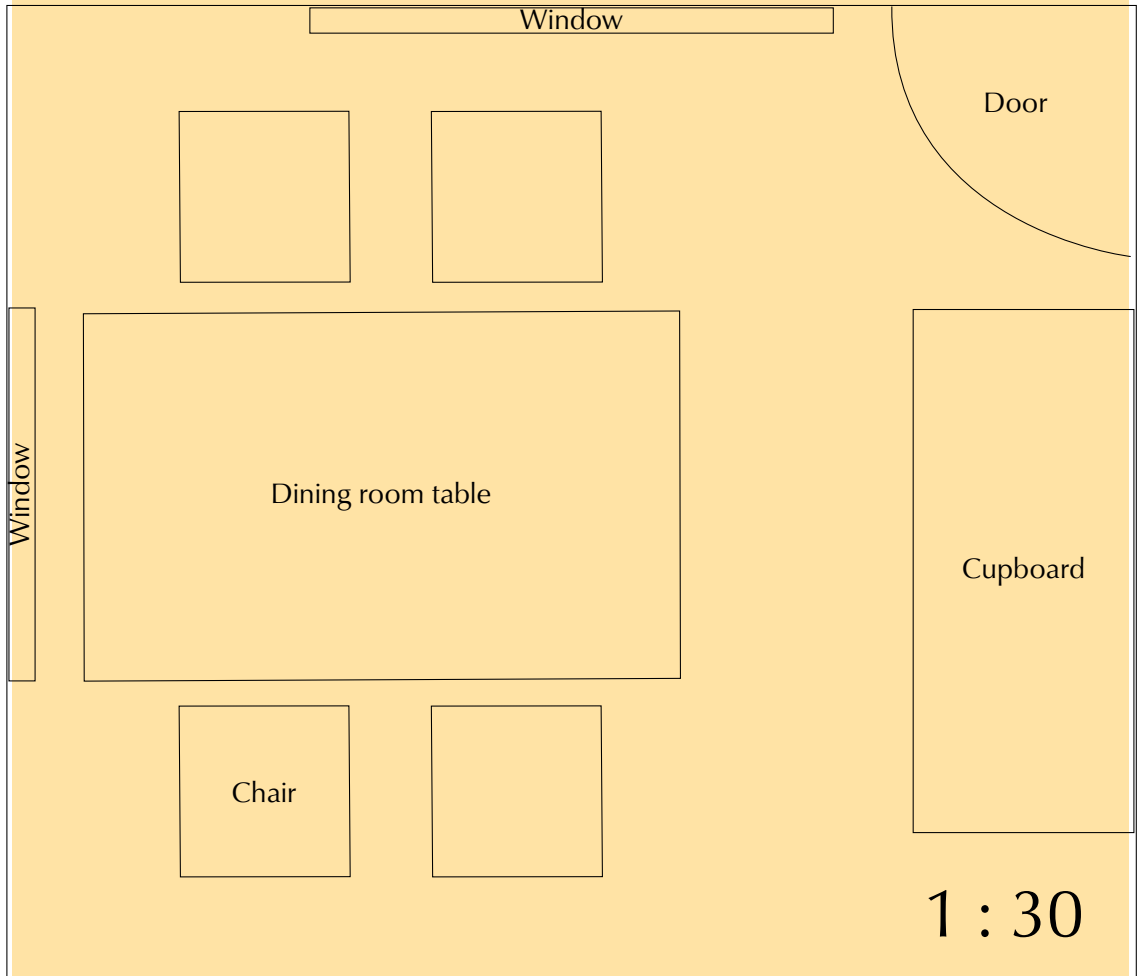
1. 24KD 2. 24KF 3. 24KG 4. 24KH 5. 24KJ 6. 24KK
7. 24KM

Activity 6 – 9: End of chapter activity

1. Study the scale diagram below and answer the questions that follow.

a) Using the number scale estimate the actual (real) size in metres of:
   i. the dining room table.
   ii. the chairs.
   iii. the cupboard.

b) Using the number scale estimate the actual (real) size of the dimensions of the room in metres.

c) Explain where the door to the room is.

d) Is it possible to calculate how high the windows are? Explain your answer.

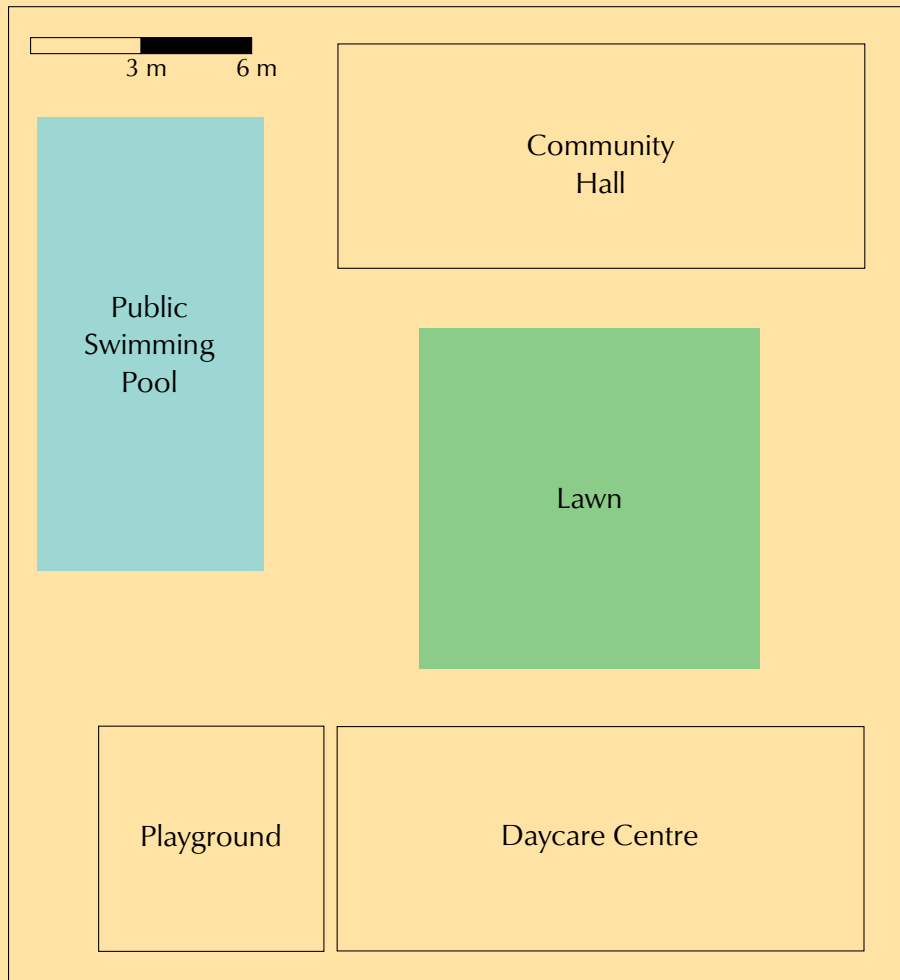
e) Calculate the width of curtaining that will be required for both windows (in cm).The width of the material required should be twice the width of the window.

f) Rearrange the furniture in this room. To help you, you can redraw and cut out the same size shapes. Draw the basic structure of the room (the walls, windows and door) in your books. Use the shapes you cut out to show your new room design. Paste them onto your room plan when you are happy with your design. You may also include some pictures from magazines to show what kind of furniture and accessories you would like in your room.

g) A carpet measures 1,8 m by 1,2 m.

   i. Using the scale 1 : 30, draw a scale version of the carpet.

   ii. Will the carpet fit into the room in Question 1? Explain your answer.

2. The following diagram shows a walled day care facility. Answer the questions that follow.

a) Use the bar scale to estimate the actual (real) size in metres of:

   i. the swimming pool.

   ii. the daycare centre.

   iii. the lawn.

b) Health and and safety regulations require that the swimming pool has a fence around it. The fence must be a minimum of 1,5 m from the pool. The fence must run from the left boundary wall (between the pool and playground) around the bottom of the pool, and then between the pool and the lawn, to the top boundary wall (i.e. it goes around the bottom and the right side of the pool). Calculate the minimum amount of fencing required.

c) Describe the position of the swimming pool in relation to the other buildings.

d) Where would you plan to dig a flower bed for the day care facility? Explain why.

e) Would a room with the dimensions 7 m $\times$ 11 m fit inside the community hall? Use your calculations to justify your answer.

f) Describe where you would put a pathway that would link all the facilities together.

3. You are given the following information about the actual dimensions of a study and the furniture in it:

   - Room: 3,6 m wide and 4,2 m long
   - Window: 1,2 m wide
   - Door: 1,2 m wide
   - Desk: 120 cm wide and 180 cm long
   - Chair: 60 cm wide and 60 cm long
   - Bookshelf: 1,5 m long

   Using a scale of 1 : 60, calculate the scaled dimensions of the room and furniture, and draw a scaled map of the room. Arrange the furniture in any sensible manner.

4. You have the following ticket for a performance at The Hillvale Theatre.

   The Hillvale Theatre
   Performance
   Seat: C 17
   Date: 15 May 2013
   Time: 20h00

   Study the seating plan on the opposite page and answer the questions that follow:

   a) Why are there only 18 seats in row J?
   b) Your ticket indicates that you must sit in C17. Which entrance would you use and why?
   c) There are 3 seats to your right between you and your friend. What is your friend's seat number?
   d) How many rows are between row B and row J?
   e) How many seats are in the theatre?
   f) Your school wants everyone to attend the stage production of your prescribed English book. There are 30 people in your class. If the first person sits in seat D5 and the class takes up the rest of row D (to D20) and seats from the beginning of row E (E1, E2 etc), where will the last person in your class sit in row E, if the seats are filled consecutively?
   g) What percentage of the seats would your class of 30 fill?
   h) Why are some rows labeled AA to FF?
   i) Are rows AA and BB on the same level? Explain your answer.
   j) Do you think the seats on the balcony wheelchair accessible?
   k) What ratio of the total number of seats are balcony seats?
   l) How many seats will still be available if $\frac{4}{5}$ of the seats are sold?
   m) The cost of the tickets for the stalls is R 200. If school groups get a 10% discount, how much will your class's 30 tickets cost the school?

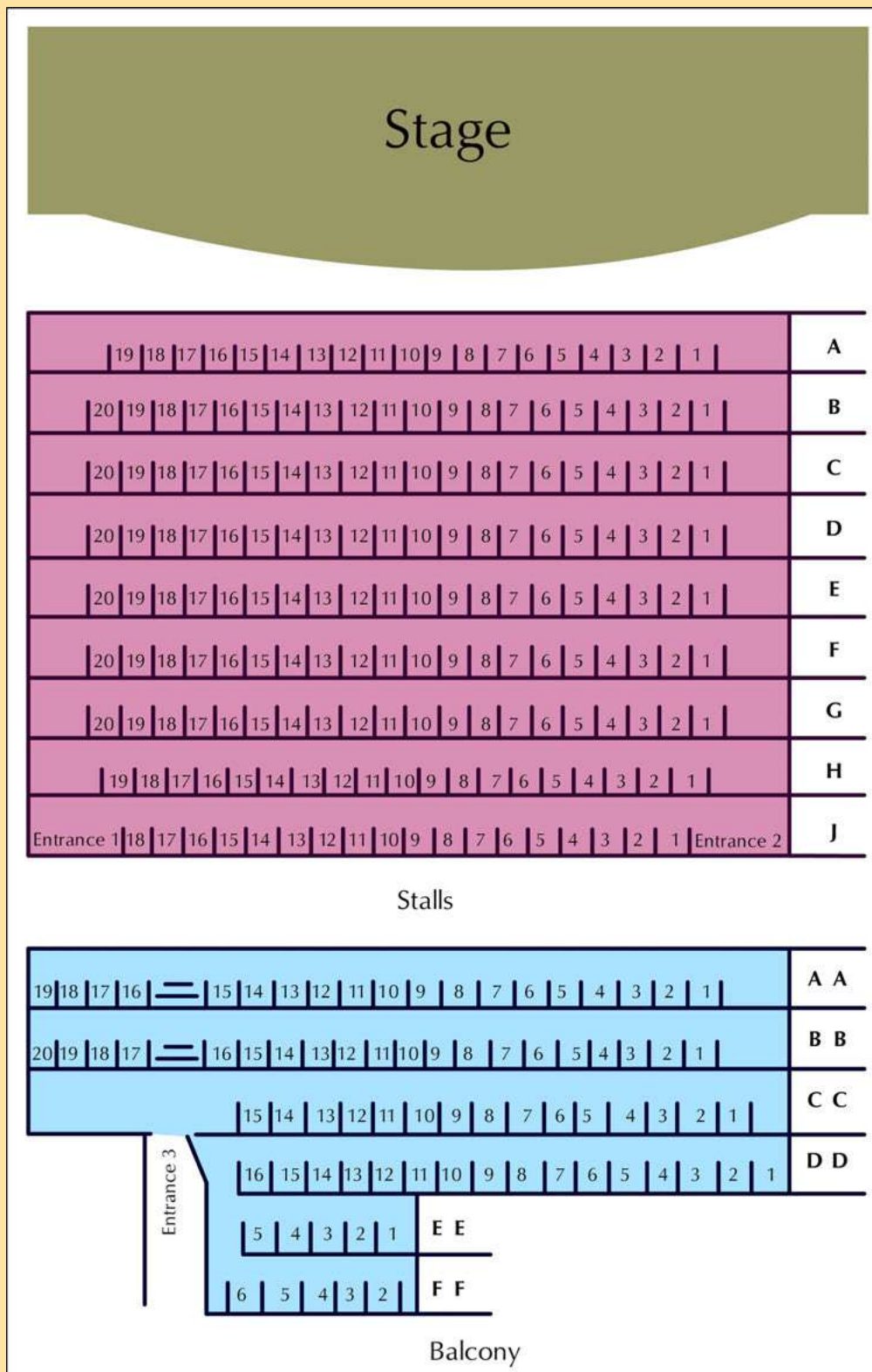



Figure 6.1:

Seating plan for The Hillvale Theatre

5. Study the seating plan of the stadium given and answer the questions that follow:

a) Describe where the players would enter onto the field.

b) Are the blocks numbered in a clockwise or anti clockwise direction?

c) Your seat is in Block 35. What entrance would you go to to get to your seat?

d) The south entrance is closest to Block 35. Where is this entrance?

e) How many blocks are there in the purple category?

f) What percentage of the blocks are red?

g) If your friend is sitting in Block 25 and you are in one of the blue blocks. Describe where you are in relation to your friend.

h) The rugby match starts at 18:30. The game is 80 minutes long. Half time is 10 minutes long.

   i. What time will the match finish? (Assuming there is no over time)

   ii. The sun sets at 6:45 p.m. behind the main entrance. Where will you be sitting if you are looking into the sun during the game?

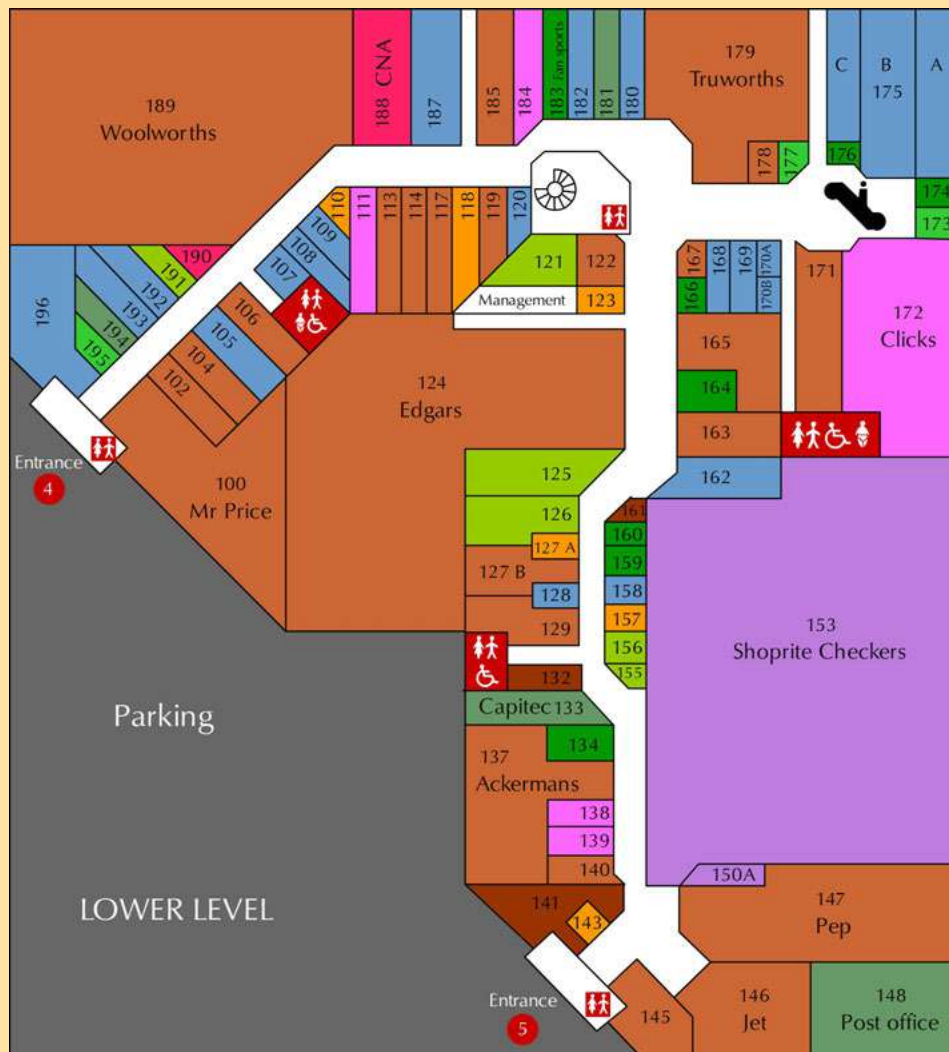
i) You are given the following ticket prices for an upcoming rugby match:

R250	R300
R450	R200

   i. Which are the cheapest seats?

   ii. You are going to buy 3 tickets for yourself and your friends in the blue category. How much will this cost?

iii. You decide that 3 tickets in the blue category is going to be too expensive and you'd rather sit in the orange stalls. How much will three orange category tickets cost?

6. Study the shopping mall map below and answer the questions that follow:

a) What would you expect to be able to do in shop 148?

b) How many 'baby changing rooms' are there on the lower level and where are they?

c) Describe how you would get from Entrance 4 to Truworths.

d) Near which entrance would you park if you wanted to shop at Shoprite Checkers and Ackermans?

e) What would be a good meeting point for you and your friends? Explain your answer.

f) Give three reasons why you would assume that this is a multi-level shopping centre.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24KN 2. 24KP 3. 24KQ 4. 24KR 5. 24KS 6. 24KT
7. 24KV

CHAPTER

Probability

7.1 Introduction and key concepts EMG4Y

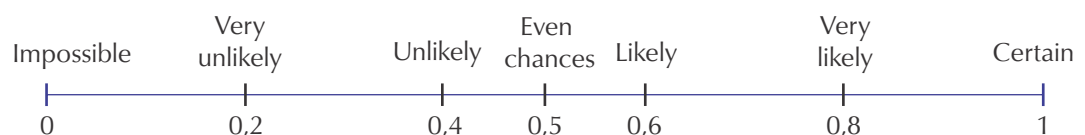
Probability is the study of the chances of things happening in future. We often make statements like “I am sure it will never happen”; “I have no chance of winning the prize!”, “I am sure it is going to snow this year.” Each of the statements tries to predict a future event.

In this chapter we will learn about:

- the probabilty scale and making predicitions.
- games of chance and fair and unfair games.
- the difference between an event and an outcome.
- tree diagrams and two-way tables.
- weather predictions.

The probability scale EMG4Z

To describe the probability that something will happen we can use a probability scale. This scale is a continuous line that starts with impossible events at the left-hand end and ends with certain events at the right-hand end. All probabilities must fall somewhere on this line. An event that is described as “impossible” is one that we know will never happen, such as having 8 days in one week. An event is described as “certain” if we know that it will definitely happen, such as having a Monday in a week. Between the two ends of the line are word descriptions: very unlikely, unlikely, even chance, likely, very likely.

We can also give numbers to the probabilities on this scale. Remember, though, that each word description covers a range of continuous probabilities on the scale, and it doesn’t match a particular number exactly. The word descriptions used describe the mathematical meaning.

Worked example 1: Working with the probability scale

QUESTION

Give each of these events a word description from the probability scale.

1. What are the chances of winning the Lottery if you buy a ticket every week for two months?
2. How likely is it that you will pass Maths Literacy this year?
3. What are the chances of rainfall in your area today?
4. What are the chances of a pregnant woman having a male child?

SOLUTION

1. It is highly unlikely that a particular person will win the Lottery.
2. Your answer here would depend on your personal situation.
3. You can give your own answer, depending on the current weather and forecasts.
4. A 50% (equal) chance.

Probabilities between 0 and 1 can be written as decimals, common fractions or percentages. So our probability scale could look like this:

In words:	Impossible	Very unlikely	Unlikely	Even chances	Likely	Very likely	Certain
As decimal fractions:	0	0,2	0,4	0,5	0,6	0,8	1
As fractions:	0	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{1}{2}$	$\frac{3}{5}$	$\frac{4}{5}$	1
As percentages:	0%	20%	40%	50%	60%	80%	100%

Activity 7 – 1: Becoming familiar with the probability scale

Work in a group to answer the following questions about the probability scale:

1. a) Think about five events that have different chances of happening.
   b) Draw a probability scale with all the word labels written on it.
   c) Discuss where these events should go on the probability scale and come to an agreement in your group. You might find that different people have different ideas about what the words on the scale mean.
   d) Write your five events on this probability scale.

2. Place these events on your probability scale:

    a) A one in ten chance of pulling a red T-shirt out of your cupboard without looking.
    b) An 80% chance of rain.
    c) A $\frac{1}{20}$ chance of having twins.
    d) A one in a million chance of being struck by lightning

3. Write these probabilities as decimals and as percentages:

    a) $\frac{1}{4}$
    b) $\frac{4}{5}$
    c) $\frac{1}{20}$
    d) $\frac{3}{100}$
    e) $\frac{6}{7}$

4. Discuss whether you think it is easier to describe a probability using a number or a word description.

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1. 24KW   2. 24KX   3. 24KY   4. 24KZ

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7.2 Prediction EMG52

Games of chance EMG53

Probability games, for example using coins and dice, help us to understand probability better. These games work with random events, so they are a useful way to learn how to use probabilities to predict events.

DEFINITION: *Frequency*

The number of times that something happens.

DEFINITION: *Random*

When something happens without being made to happen on purpose.

DEFINITION: *Trial*

A test. Throwing a dice or tossing a coin are examples of a trial.

DEFINITION: *Fair*

Treated equally, without having an advantage or disadvantage.

Random events and equal chances

Two important points make games of chance useful for learning about probability:

First, the events in probability experiments are **random**. This means that they cannot be deliberately influenced in any way (provided that the game is fair!). There is no way of making a fair dice fall on one number rather than another.

Second, each possible outcome has an **equal chance** of occurring. All the numbers on a dice have exactly the same chance of coming up when the dice is tossed: i.e a 1 in 6 chance.

Because of these two facts, we know that when we toss a coin, we have a 50% or 0,5 or $\frac{1}{2}$ chance of getting heads, and a 50% or 0,5 or $\frac{1}{2}$ chance of getting tails.

Similarly, on a dice, there is a 1 in 6 chance of throwing a 1; 2; 3; 4; 5 or 6.

This chance is called the **theoretical probability.**

DEFINITION: *Theoretical probability*

The calculated probability, not the actual result.

When you do a probability experiment, such as tossing a coin a number of times, you find the **relative frequency** of each outcome. For example, if you toss a coin 10 times and you get Heads 3 times, then the relative frequency is simply 3 in 10 or $\frac{3}{10}$.

The difference between an event and an outcome

An **outcome** is the result of a single trial. For example, if I roll a dice, one outcome would be a 6. An **event** is a collection of one or more outcomes. Using the example of rolling a dice, an event might be rolling an even number. Thus this event consists of any of the outcomes 2; 4; 6.

Activity 7 – 2: Experimenting with games of chance

1. Work in groups to carry out the following experiment and record your results. You will need coins and dice for each group.

   Each of you should flip a coin 20 times. Record your results in a tally table like this:

	Tally	Total
H		
T		

   a) Calculate the relative frequency of Tails, by working out the fraction of 20, the decimal fraction and the percentage.

   b) How does this compare to the theoretical probability of 50%?

   c) Now put all your results together. Work out the relative frequency of Tails as:

      i. a fraction out of 100.

      ii. a decimal fraction.

      iii. a percentage.

   d) Do the combined results get closer to 50% than your results on their own?

   e) What was the relative frequency of Heads in each case?

   You should find that the relative frequency gets closer to the theoretical probability when you increase the number of throws. Each result is caused by chance, and eventually the experiment will reflect the theoretical chance.

2. a) What is the theoretical probability for each outcome when you throw a dice? In other words, what fraction describes how often you expect to get each number?

   b) Draw up a table for all the possible outcomes for throwing a dice.

   c) Throw the dice 50 times and keep a tally of the results.

   d) Calculate the relative frequency of each outcome.

   e) How do the answers in d) compare to the expected probability in a)?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24M2 2. 24M3

Activity 7 – 3: More games of chance

1. Most dice are cubes, which means that they have six identical faces. It is also possible to get dice with different numbers of faces. As long as all of the faces are the same shape and size, the dice should still be fair.

   The photograph below shows some dice with 8 faces.

   a) List the possible outcomes when throwing one of these dice.
   b) What are the theoretical chances of throwing a "7" on one of these dice?
   c) Is it more likely that you will get an even number on these dice than on normal 6-sided dice? Explain.

2. Work in two groups to carry out a new probability experiment. Colour in some paper disks red and blue. One group should make 8 red disks and 4 blue disks. The other should make 4 red disks and 4 blue disks.

   a) Put the disks into a closed box or bag and take turns to draw a disk out and note down which it is. (Remember to put the disk back each time.)
   b) Draw up a table and record your results.
   c) Write a few sentences to describe the difference in the two groups' results.

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1. 24M4 2. 24M5

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7.3 Fair and unfair games EMG54

Do you think games of chance are always fair?

So far all of the games that we have looked at are fair because you have an equal chance of winning and losing. But some games are designed to be unfair. Do gamblers have a good chance of winning? Are you more likely to win if you are luckier?

Many games of chance are designed to make one person have a better chance of winning that the other. Every now and then, the loser will win, which gives them confidence to carry on playing! However, if the game is weighted towards one player,

then that person will always win in the end.

When you know the chance of a particular event, then you can make predictions about the probability of it happening. A fair game is a game in which there is an equal chance of winning or losing. We can say that if a game is fair then the probability of winning is equal to the probability of losing.

If you change the rules, you can make the game less fair. For example, if someone wins a game of dice only if they get a 3, is it a fair game?

In the next activity you will make your own simple games and decide which rules give a player a good chance of winning, which games are fair or unfair and why.

Activity 7 – 4: Fair and unfair games

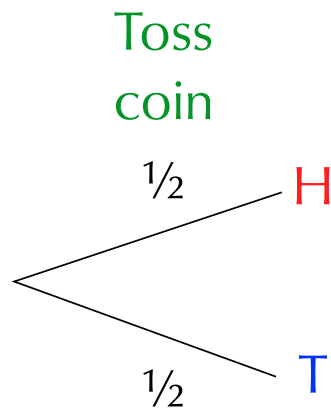
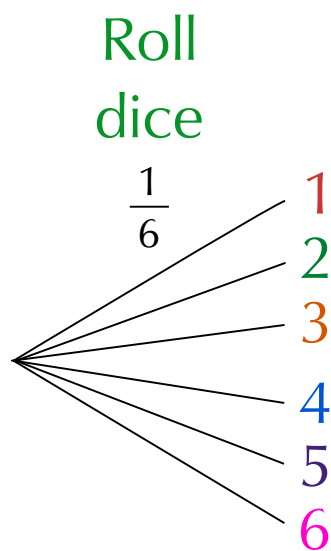
1. In this activity you need to invent fair and unfair games. Invent your two games using a single dice. You must explain clearly how a person can win the game. Make:
   a) a fair game.
   b) an unfair game.
2. Write a paragraph explaining how your games work.
3. Which of these games is more likely to be used by a person who is planning to make a lot of money out of the game? Why?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24M6 2. 24M7 3. 24M8

7.4 Single and combined outcomes EMG55

Single outcomes EMG56

In this section we will explain and show how to draw a tree diagram. If we flip a coin there are two possible outcomes. There is a $\frac{1}{2}$ chance of getting Heads and a $\frac{1}{2}$ chance of getting Tails. Representing this in a tree diagram would look like this:

If we are rolling a dice the tree diagram would look like this. There is a $\frac{1}{6}$ chance of getting each number.

Combined outcomes EMG57

In this section we will use two outcomes to create more interesting games. To make sure we list all possible outcomes of the two events, we use two tools called tree diagrams and two-way tables.

Lets take these two situations mentioned above and combine their outcomes. I.e. we are going to flip the coin once and throw the dice once. We now have a **combined** event.

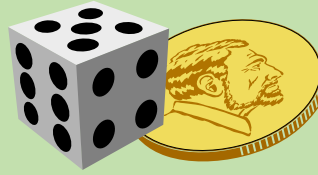
When we use more than one object or we repeat an experiment, we call this a **compound** event. For example, we could get Heads on the coin and a 2 on the dice and we could write this result as H2.

Now we need to use a different process for listing all the possible outcomes.

Tree diagrams of combined outcomes

Let's look at how a tree diagram is used to show combined outcomes.

Worked example 2: Using a tree diagram for combined outcomes

QUESTION

The tree diagram below shows all the possible outcomes for tossing a coin and then throwing a dice.

1. How many possible outcomes are there?
2. What is the probability of getting each outcome? Write this probability as a fraction, a decimal and a percentage.
3. How many possible outcomes out of the 12 include getting an even number on the dice?
4. How many possible outcomes out of 12 include getting Tails and an even number?
5. How many possible outcomes out of 12 include getting a 5 on the dice?

SOLUTION

1. There are 12 possible outcomes altogether.
2. The probability is $\frac{1}{12} = 0{,}08 = 8\%$.
3. H2; H4; H6; T2; T4; T6 - six of them.
4. T2; T4; T6 - three possible outcomes.
5. H5 and T5 - two possible outcomes.

Using a two-way table to show combined outcomes

A two-way table (also known as a contingency table) works in a similar way to a tree diagram. We write the outcomes of one event in rows and the outcomes of the other event in columns.

For example, this table shows all the possible combinations for tossing a coin twice.

	H	**T**
H	H, H	H, T
T	T, H	T, T

So each block in the table will show a possible outcome of the combined events. Let's look at a worked example to understand this better.

Worked example 3: Using a two-way table for combined outcomes

QUESTION

1. Draw up a two-way table to show all the possible outcomes for tossing a red dice and a blue dice.
2. How many possible outcomes are there?
3. Now answer the following:
   a) What is the chance of rolling a 31 on the blue dice (and any number on the red dice)?
   b) Write the probability of getting a 5 on the blue dice as a:
      i. fraction.
      ii. decimal fraction (round off your answer to 2 decimal places).
      iii. percentage (round off your answer to 2 decimal places).

c) What is the chance of rolling a 4 on the red dice and a 2 on the blue dice?

4. What is the chance, in a single roll of both dice, of you getting a 1 and a 2 of either colour?

SOLUTION

1. For tossing a red dice and a blue dice we would have:

Blue/Red	**R1**	**R2**	**R3**	**R4**	**R5**	**R6**
B1	(B1; R1)	(B1; R2)	(B1; R3)	(B1; R4)	(B1; R5)	(B1; R6)
B2	(B2; R1)	(B2; R2)	(B2;R3)	(B2; R4)	(B2; R5)	(B2; R6)
B3	(B3; R1)	(B3; R2)	(B3; R3)	(B3; R4)	(B3; R5)	(B3; R6)
B4	(B4; R1)	(B4; R2)	(B4; R3)	(B4; R4)	(B4; R5)	(B4; R6)
B5	(B5; R1)	(B5; R2)	(B5; R3)	(B5; R4)	(B5; R5)	(B5; R6)
B6	(B6; R1)	(B6; R2)	(B6; R3)	(B6; R4)	(B6; R5)	(B6; R6)

So, for example, (B1; R3) represents rolling a 1 on the blue dice and a 3 on the red dice.

2. There are 36 possible outcomes.

3. a) The chance is 1 in 6 or $\frac{1}{6}$.

   b) i. $\frac{1}{6}$

      ii. 0,17

      iii. 16,67%

   c) There is only one block on the table for this: (B2; R4). so there is a 1 in 36 chance of this outcome.

4. To get a 1 and a 2: could be (B1; R2) or (B2; R2), so there are two possible outcomes and hence a 2 in 36 chance. This simplifies to 1 in 18 or $\frac{1}{18}$.

Activity 7 – 5: Calculating combined outcomes

1. Look at the table given for all the possible outcomes for tossing two coins.

	H	**T**
H	H, H	H, T
T	T, H	T, T

   a) How many possible outcomes are there altogether?

   b) How many possible outcomes are there for getting two Heads (H; H)?

   c) What is the probability of getting two Heads?

   d) Is the probability of getting two Heads the same as the probability of getting two Tails?

e) How many possible outcomes are there for getting one Heads and one Tails, in any order?

f) Is the probability of getting one Heads and one Tails greater or smaller than the probability of getting two Heads? Explain your answer.

2. A bag contains 5 balls: 2 red (R) and 3 blue (B). In a game of chance, a learner takes a ball out of the bag without looking, notes down the colour, and then puts it back into the bag. The learner then takes out another ball, notes down the colour and puts it back into the bag.

   The two-way table shows all of the possible outcomes for this game.

	R	**R**	**B**	**B**	**B**
R	R; R	R; R	B; R	B; R	B; R
R	R; R	R; R	B; R	B; R	B; R
B	R; B	R; B	B; B	B; B	B; B
B	R; B	R; B	B; B	B; B	B; B
B	R; B	R; B	B; B	B; B	B; B

   a) How many possible outcomes are there?

   b) How many of the events represent getting R and then B?

   c) Use your list to say what the probability of getting R and then B is.

   d) What is the probability of drawing blue twice?

3. In a game of chance, learners toss two coins, a R 1 coin and a R 2 coin.

   a) Draw up a two-way table to show all the possible outcomes.

   b) How many possible outcomes are there altogether?

   c) How many of the events are two Heads (H; H)?

   d) In how many of the events is there only one Heads?

   e) How many of the events are two Tails (T; T)?

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1. 24M9 2. 24MB 3. 24MC

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7.5 Weather predictions EMG58

	M	T	W	TH	F	S	S
Chance of rainfall	70%	80%	90%	80%	60%	20%	0%

Have you ever wondered what it means when the weather report says that there is a 60% chance of rain?

The 60% chance is calculated in a similar way to how we have calculated probability in this chapter.

Forecasts like these are calculated by the South African Weather Service when they look at all other days in their database that have the same weather characteristics (temperature, pressure, humidity, etc.) and find it rained that on 60% of days with the same weather characteristics.

DEFINITION: *Database*

An organised collection of information, often collected over time that is organised in such a way that it is can be easily accessed, updated and managed. A database may take the form of paper, e.g. a telephone book is an example of a paper database. Facebook is an example of a computer database that stores friends' information and photos.

To calculate probability we divide the number of favourable outcomes by the total number of possible outcomes. If we want to know the probability that it will rain, this will be the number of days in our database that it rained divided by the total number of similar days in our database. If we have data for 100 days with similar weather conditions (the sample space and therefore the denominator of our fraction), and on 60 of these days it rained (a favourable outcome), the probability of rain on the next similar day is $\frac{60}{100}$ or 60%.

Since a 50% probability means that an event has an equal chance of occurring and not occurring, 60%, which is greater than 50%, means that it is more likely to rain than not. But what is the probability that it won't rain? Remember that because the favourable outcomes represent all the possible ways that an event can occur, the total of the probabilities must be equal to 100%, so 100% − 60% = 40%, and so the probability that it will **not** rain is 40%.

Activity 7 – 6: Working with weather predictions

1. Try to find three different weather forecasts for your area. Listen to weather reports on the radio, watch them on the television and read them in newspapers. Collect information for a week about the predicted temperatures and the predicted rainfall.
2. Keep a record of what the weather is actually like on the day and note whether it was different or similar to the predicted weather.
3. If a weather prediction was very different from the weather that you experienced in reality, explain why this could have happened.
4. Explain how weather forecasters use past data about the weather to predict the weather.
5. If a weather forecast says there is a 80% chance that it will rain in your area, does that mean that you will definitely see rain? Is there a chance that it will not rain where you are? Explain.

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1. 24MD 2. 24MF 3. 24MG 4. 24MH 5. 24MJ

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Activity 7 – 7: Weather predictions

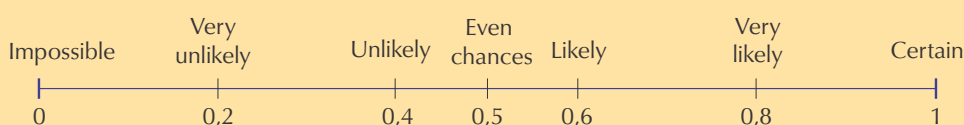
1. When one enters some games reserves and national parks in South Africa managed by SA National Parks you will find a sign in the form of a pie chart indicating the risk of a fire occurring in the park that particular day. Look at the picture of one of these fire risk pie charts and determine what weather predictions the fire risk probability is based upon.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24MK

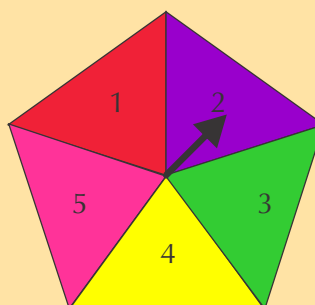
7.6 End of chapter activity EMG59

Activity 7 – 8: End of chapter activity

1. On the probability scale below choose the which words best describe the probability of each of the following events:

   a) The chance of visiting Mars.
   b) The sun rising tomorrow morning.
   c) Getting snow in the Kruger National Park in December.
   d) The chance of getting rain in the Sahara Desert.
   e) The chance of throwing Heads on a coin.

2. Fill in the numbers in this table to show probabilities in different number formats.

Fraction (simplest form)	Decimal fraction	Percentage
$\frac{3}{4}$	0,75	
	0,3	
		10%
		90%
$\frac{1}{8}$		

3. Look at the five-sided spinner shown in the diagram. When we spin the arrow, it has an equal chance of landing in each triangle, because they are all the same size.

Answer the following questions:

a) List all the possible outcomes for getting an even number.

b) List all the possible outcomes for getting an odd number.

c) Is there an equal chance of getting an odd number and an even number? Explain.

d) How could you use this spinner to design an unfair game of chance?

4. a) Draw a tree diagram with the first set of branches showing the possible outcomes for spinning the spinner in question 3. Then add the outcomes for a coin toss to each of the branches.

b) How many possible outcomes are there altogether?

c) How many outcomes are there for getting a 4; H?

d) What is the probability of getting a 4; H?

e) How many outcomes are there for getting an even number and Heads? List them.

f) What is the probability of getting an even number and Heads?

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1. 24MM 2. 24MN 3. 24MP 4. 24MQ

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CHAPTER

Personal income, expenditure and budgets

8.1 Introduction and key concepts EMG5B

In this chapter you will learn about the difference between personal income and expenditure and how they relate to one another. You will also learn how to compile simple budgets based on household income.

You will learn how to identify and perform calculations involving income, expenditure, and profit and loss values including:

- fixed, variable and occasional income.
- fixed, variable, occasional high- and low-priority expenses.
- personal and household budgets.

8.2 Personal income and expenditure EMG5C

Income EMG5D

An income is any way in which people earn money, and there are many different types of income to consider. Here are some of the ways in which people earn money.

- Some people have jobs and receive wages or salaries.

DEFINITION: *Salary*

A fixed amount of money paid by an employer to an employee for work done over some longer period of time - usually per month or per year.

DEFINITION: *Wage*

An amount of money paid by an employer to an employee for work done in some shorter period of time - usually hours or days per week.

- Some people may earn commission, which is a fixed, extra amount of money paid to them, based on an agreement for providing additional services. For example, a hairdresser might earn a basic salary for doing hairdressing, but could earn extra money (a commission) for also selling the salon's products, such as shampoos and conditioners, to customers.

- If you produce and sell goods or services, the money you make - in the form of profit - is also income. To calculate your profit on any sale, you need to subtract the cost of producing the goods or providing the services from the total amount of income you received.
- People working in the service industry could also receive gratuities (tips) as well as their wages.

- People sometimes receive money as a gift, and young people sometimes receive pocket money from their parents or guardians.
- Someone who owns a property could rent it out and receive rental income.

DEFINITION: *Budget*

A budget is a plan of action to balance your expenditure with your income. it is usually displayed as a table of income items in one column and expenditure items in another. The last row of the budget shows the difference between income and expenditure. When income exceeds expenditure (your income is more than your expenses) then it is called a surplus. when expenditure exceeds income (your expenses are more than your income) then it is called a deficit or shortfall.

DEFINITION: *Study loan*

A loan granted to students to assist them with all financial matters throughout their study period. it is a loan that is only given providing certain conditions are met which probably include (after graduation) a repayment plan.

DEFINITION: *Bursary*

A bursary is financial assistance that is granted to previously disadvantaged students. bursaries are mostly granted by government, as well as by large companies in the private sector.

Figure 8.1:

The University of Cape Town

Personal income is money that is paid to you, or that comes into your possession or bank account. Income can be paid to you in the form of a salary or wage for work undertaken, and it ranges from gifts or pocket money (e.g. from your parents) to bursaries or loans, savings, interest earned on your savings and income from inheritance.

There are three types of income: fixed, variable and occasional income.

- **Fixed** income is an amount of money a person receives, which does not change with time. Salaries and wages are examples of fixed income.
- **Variable** income is an amount of money a person receives that changes over time, or changes according to the situation. Commissions and interest on investments or savings are examples of variable income.
- **Occasional** income is when someone receives money from time to time. Examples of occasional income may include gifts (e.g. money for your birthday) or inheritance (e.g. if a family member passes away and leaves money to you in their will).

Worked example 1: Classifying personal income

QUESTION

Mr Sibong works as a sales manager for his company. He is a full-time employee, and he also gets commision on all sales he makes, on behalf of the company.The table below lists the different types of income he receives.Study the table and place a tick in one of the boxes for each row, to indicate whether the type of income is fixed, variable or occasional.

Types of income	Fixed	Variable	Occasional
Salary			
Interest received from fixed account			
Income received from renting out a flat			
Bonus			
Cash gift from friends			
Sales commission			
Transport allowance			

SOLUTION

Types of income	Fixed	Variable	Occasional
Salary	✓		
Interest received from fixed account	✓		
Income received from renting out a flat	✓		
Bonus			✓
Cash gift from friends			✓
Sales commission		✓	
Transport allowance	✓		

Activity 8 – 1: Personal income

1. Read the paragraph below and identify all Petrus's sources of income. Classify each source of income as fixed, variable or occasional.
   Petrus has just started his first job and he earns a basic salary as a sales representative, and also receives allowances for cell phone and travel. He also gets paid commission every three months on the sales that he makes.

He has started a small music band and he sometimes gets asked to play at events such as birthday parties and weddings, where he negotiates his hourly fee.

2. You are currently in Grade 10 and in order to earn extra money you accept a job at a Spur restaurant as a waiter. You work the following shifts per month:

   - Four Friday shifts per month for 5 hours. Friday rate/hour = R 20
   - Four Saturday shifts per month for 10 hours. Saturday rate/hour = R 30
   - Two Sunday shifts per month for 8 hours. Sunday rate/hour = R 40
   - Estimated tips earned per month = 1,5 × your monthly salary.

   Calculate your total income for one month.

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1. 24MR 2. 24MS

Expenditure EMG5F

Personal expenditure is money that you spend. Expenditure can include living expenses (e.g. food, clothing, entertainment), accounts (e.g. water, electricity, telephone), fees (e.g. school fees), insurance (e.g. for a car or house), taxes and loan repayments (e.g. to pay off your store account).

As with expenditure, there are fixed, variable and occasional or unexpected expenses. Fixed expenses are the amounts of money a person spends, which do not change over time - for example rental for a flat. Variable expenses are amounts of money a person spends that do change over time. Groceries or electricity bills are examples of variable expenses. Occasional or unexpected expenses are sometimes expenses that you cannot plan for, for example a visit to the doctor, or repairs to your car if it breaks down. Some occasional expenses can be planned for, for example, annual car services.

It is important to monitor your income and expenses each month, in order to manage your money carefully and plan your activities in such a way that you do not spend more money than you have, and get into debt. It is also important to try to save money so that you can pay for unexpected expenses (like a visit to the doctor). You can also decide which of your expenses are high and low priority. For example, if you are running low on money at the end of a month, buying food is more important, or of higher priority, than buying music CDs or going to the movies.

DEFINITION: *Debt*

The amount of money owed.

Worked example 2: Classifying personal expenditure

QUESTION

Complete the table below by classifying the following expenses as fixed, variable or occasional:

Types of expenses	Fixed	Occasional	Variable
Rent			
Transport (public)			
Groceries			
Rates and taxes			
Vehicle repairs			
Telkom account			
Vodacom contract account			
Water and electricity			
Petrol			
Insurance premium			

SOLUTION

Types of expenses	**Fixed**	**Occasional**	**Variable**
Rent	Fixed		
Transport (public)			Variable
Groceries			Variable
Rates and taxes	Fixed		
Vehicle repairs		Occasional	
Telkom account			Variable
Vodacom contract account	Fixed		
Water and electricity			Variable
Petrol			Variable
Insurance premium	Fixed		

Activity 8 – 2: Personal expenditure

1. You decide to spend your income in the proportions shown below:

Clothes	30%
Entertainment	10%
Savings	10%
Charitable organisations	25%
Transport	12%
Sweets and cool drinks	13%
Total:	100%

   If you earn an income of R 1200 in a particular month, calculate exactly how much money you will be spending on each of the above items.

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1. 24MT

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8.3 Personal budgets, income and expenditure statements EMG5G

Drawing up a budget is a good way to plan your expenditure based on how much money you expect to receive. Budgets are often estimates, because you cannot easily include unexpected expenses in a budget. However, you can plan to save some money that you can use in the event of an unexpected expense. Budgeting includes normal monthly budgeting and budgeting for particular expenses, such as an expensive item that you want to buy, a project or a trip overseas.

Monthly budgeting EMG5H

To produce a budget you need to estimate what your income and expenses should be for a given month. You might already know exactly how much your income is, if it is fixed.

Your budget should help you to get the most out of your money and will help to enable you to have enough money to cover all your expenses.

There are several things you should aim for in your personal budget:

- It should list all of the items that are needed and should try to anticipate unforeseen expenses.
- It should be realistic, so that you can keep to it.
- It should focus on the high priority items (essential items such as food and health care). If too much of the income is spent on non-essential items and not on savings, your budget is going to become problematic in the future.
- An ideal budget should include a plan to save money for the future, or to pay off debts to allow for savings in the following months.
- It should be balanced. If your income is less than your expenses, then you need to revise it until the two sides balance. If your income is more than your expenses, then you should plan to save the extra money.

Activity 8 – 3: Managing a personal monthly budget

Jacob is a young man in his first job. He earns a salary of R 5900. He has the following expenses:

Rent	R 1500
Clothing	R 260
Water and lights	R 280
Satellite TV subscription	R 280
Taxi transport	R 900
Groceries	R 940
Cell phone contract	R 99
Magazines	R 180
Instalment on DVD player	R 350
Bank charges	R 52
Entertainment	R 580
Medicine	R 120

1. Classify each item of his expenses as high priority or low priority.
2. Calculate the total cost of his variable expenses.
3. Jacob has no savings plan and lives just within his income.
    a) Write down a few things that could happen that would make him unable to live within his income.
    b) What expenses could he reduce to help him to save up for unforeseen expenses?

4. Suppose now that Jacob earns R 6500 each month. He could choose to buy a flat screen TV on hire purchase but he still owes R 2000 on the DVD player. What would you advise him to do?

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1. 24MV 2. 24MW 3. 24MX 4. 24MY

Budgeting for particular items or events EMG5J

In this section we look at situations in which we need to plan for a certain event, rather than for monthly expenses.

Worked example 3: Budgeting for a party

QUESTION

1. Jennifer is planning to have a party. She is going to charge a small fee (R 20 per person) at the door to help cover her costs. She expects 50 friends to come to the party. She is also going to spend some of her own money on the catering. Jennifer draws up a budget and anticipates that her income and expenditure will be as follows:

Income			Total
	Cover charge at door	R 20 $\times$ 50 friends	R 1000,00
	Jennifer's contribution	R 400	**R 1400,00**

Expenditure			Total
	Juice	R 200	R 200,00
	Cake	R 300	R 500,00
	Paper plates and cups	R 100	R 600,00
			R 600,00

a) Can you think of any other expenses she has forgotten to include in her budget?

b) If all 50 friends arrive and Jennifer sticks to her budget of R 600 worth of expenses, how much money will she have left over?

c) At the last minute, Jennifer decides to hire a DJ to play music at her party. The DJ charges her R 400. Does she have enough money to cover this expense? And how much money will be left once she's paid the DJ?

d) **SITUATION A**: Jennifer is expecting 50 friends to come to the party but only 9 arrive. How much money does she now have and can she still afford her expenses?

e) **SITUATION B**: Jennifer expected 50 friends and 48 friends arrived.

   i. How much money will she make from the cover charge?

   ii. Copy the income and expenditure tables given above and fill in the new information (including the money for the DJ). Calculate the new totals.

   iii. What do you think Jennifer should do with the money left over? Discuss with your class.

2. It is Thabo's birthday next month and he wants to have a party. He needs to think about how much it is going to cost. His mom suggests that he send out party invitations. The invitations would include details of the date, time, party venue and contact details, with a request to reply (RSVP) date. Printing the invitations would cost R 80. Based on what you learnt about budgets, would you advise Thabo to send invitations? Discuss with the rest of your class.

SOLUTION

---

1. a) Examples could include streamers and balloons, hiring a sound system, etc.

   b) R 1400 − R 600 = R 800.

   c) Expenses = R 600 + R 400 = R 1000.
   She will have R 400 left once she's paid the DJ.

d) R $9 \times 20 = $ R 180.
R 180 from friends + R 400 from Jennifer's savings = R 580.
Therefore Jennifer will not have enough money to cover her expenses. She will need to pay R 20 more.

e) i. R $20 \times 48 = $ R 960

ii.

Income			Total
	Cover change at door	R 20×50 friends	R 960,00
	Jennifer's contribution	R 400	**R 1360,00**

Expenditure			Running total
	Juice	R 200	R 200,00
	Cake	R 300	R 500,00
	Paper plates and cups	R 100	R 600,00
	DJ	R 400	R 1000
			R 1000,00

iii. Open for discussion. She could keep the money so that she does not need to put forward R 400. She could take the total money left over and divide it between all the friends who came to the party.

2. If Thabo gave out invitations, he would have a better idea of how many people were coming then he will be able to make a more accurate estimate of how much food to buy and how much money he can spend.He will therefore be less likely to overspend.

Activity 8 – 4: Understanding a budget

1. Sam is currently in Grade 12 and he works part-time at Checkers Hypermarket to earn money. Sam's monthly budget is as follows:

Budget	Expenditure	Income
Earnings from Checkers		R 800
Allowance from parents		R 200
Transport	R 80	
Food	R 160	
Entertainment	R 200	
Clothes	R 180	
Unforeseen expenses	R 100	
Interest received from fixed account deposits		R 50

Investment in fixed account	R 100	
Present for girlfriend	R 100	
Total	R 920	R 1050
Surplus or deficit	Income − Expenditure	R 1050 − 920 = 130

a) Estimate what fraction of total expenditure he plans to spend on clothes.

b) Now express your answer for the previous question as a percentage.

c) Estimate as a fraction of total income the amount of money he earns at Checkers. Express it as a percentage of total income.

2. Thando and Lisa are thinking of going on a planned adventure hike. They find the following advertisement from a company who arrange hikes.

Normal cost is R1 800.
Trip leaves on Friday 21 September,
returns on Sunday 23 September.
Price includes transport, tents, meals, SANParks fees
and maybe a free stone from the summit if you make it to the top!
Hikers need to have a moderate fitness level
as the hike is about 40 km long.

Additional costs over and above the quoted price include:

- **Equipment hire** (if you don't have any hiking equipment.)
  for R25 per item per day.
  We supply tents and cooking equipment, gas, etc.
  however, you will need a sleeping bag, a sleeping mat
  and a rucksack (backpack).
  We do not hire out clothing. It's a good idea to check
  out our proposed equipment list as well as our advice on
  proper layering.
- **Breakfast** on the way there, in Harrismith
- **Lunch** on the way back, in Harrismith
- **Drinks** after hike

Draw up a budget for both of them, assuming that they do not have any equipment of their own.

3. Douglas wants to travel from Cape Town to Durban to visit his cousin. His parents said that they can give him R 500 towards the trip. He decides to draw up a budget to determine how much money the trip will cost. His uncle has offered to give him a lift home so he only needs to budget for the trip to Durban. He has R 2000 saved in his bank account. He wants to have some spending money left over when he gets there.

   He phones Rainbow Buses to find out how much it costs to travel from Cape Town to Durban. They give him two options:

   OPTION 1: Leave Saturday morning and travel straight to Durban. The trip costs R 1200 and he will need to pay for 3 meals at R 30 per meal

   OPTION 2: Leave Saturday morning and travel to Plettenberg Bay first. The trip costs only R 400. He can then catch a bus on Sunday morning to Durban. This bus trip will cost R 500. If he does this he needs to find a place to stay on Saturday night and budget for three extra meals (estimated at R 30 each). He estimates that a Backpackers' Lodge would be the cheapest place to stay, at R 200 a night.

	Income	**Expenses**	**Running total of money that he has**
Money from parents			
Savings			
Bus fare			
Meals on bus			
Accommodation			

   a) Copy the above budget sheet and fill in the amounts for income and expenses in the correct columns for:
      i. Option 1.
      ii. Option 2.
   b) Would you advise Douglas to take Option 1 or Option 2? Explain your answer.

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1. 24MZ 2. 24N2 3. 24N3

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8.4 The difference between budgets and statements

EMG5K

A statement is a record of actual expenditure, rather than planned expenditure. We usually compare the actual expenditure to planned expenses at this stage.

Activity 8 – 5: Understanding a statement

1. Consider the previous activity, where Douglas planned to travel to Durban. He eventually decided to travel to Durban using bus Option 1. He kept all the receipts and till slips so that he could write a statement to see how much money he actually spent. Read the following summary of Douglas's bus trip:

   When Douglas arrived at the bus station to buy the ticket, he finds that the advertised price did not include VAT, and he needs to add 14% to the cost. To add to his problems, the bus breaks down and Douglas needs to find a place to stay the night in Knysna. He finds a backpackers' lodge that costs R 200 a night for a shared room. He also needs to rent a locker for R 20 to keep his luggage safe. He needs to buy both supper and breakfast, which cost him R 30 each.

   a) Fill in a table like the one used for his budget, to show his actual expenses. You may need more rows in the table.

Expenses	Amount	Running total

   b) What is the amount of money he ends up with as spending money in Durban? (Remember: he had R 2500 to begin with).

2. A household has the following monthly expenses:

   - rent R 2300;
   - transport R 520;
   - cell phone R 200;
   - pre-paid electricity R 800;
   - water bill R 350;
   - TV contract R 250;
   - loan repayment R 310;
   - furniture store account R 570;

- clothing store account R 315;
- groceries R 2500;
- medical expenses R 75

They live on the following monthly income: a state pension of R 1140, a disability grant of R 1140 and a salary of R 5250. This month, one of the children falls ill and they have additional medical expenses of R 500 for doctor's visits and medication.

a) Draw up a statement for the household for this month.
b) What is the total difference between the income and expenses?
c) Which costs could be reduced in their budget?
d) If those costs were reduced, would the family have enough money to cover their expenses?
e) What advice would you give the family? Write down two suggestions.

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1. 24N4 2. 24N5

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8.5 The importance of saving EMG5M

Saving is a good way to prepare for unexpected costs, annual bills and important events. These could be essential or non-essential expenses such as medical costs, a trip, a party or car repairs and servicing. Also keep in mind that your circumstances can change very quickly, and you need to be prepared for this.

It is more important to repay debts before starting to save, because you need to pay interest on debts. Debts also tie up money that could be used for savings. When you are living on a strict budget there might be little or no spare money to set aside. However, your financial situation can get worse rapidly if there is no money set aside for unexpected expenses.

Budgeting for savings EMG5N

You may be able to save money on things you are already paying for, so you can put it aside for when you really need it. For example, if you have insurance policies, you might be able to find a better deal by investigating alternative policies. If you are paying a lot of interest on a credit card, you could find out if you can transfer the balance to an account that charges less interest.

8.6 End of chapter activity EMG5P

Activity 8 – 6: End of chapter activity

1. Chuma writes down the following percentages for each of the items in her budget:

Clothes	40%
Entertainment	30%
Fixed savings account	10%
Transport	5%
Donations	5%
Tuck shop spending	10%
Total	100%

If she has earned an income of R 500 in a particular month, calculate exactly how much money she can allocate to each of the above items.

2. Amanda budgeted her monthly expenses as follows:

Clothes	25%
Entertainment	40%
Transport	10%
Tuck shop spending	15%
Donations	5%
Unforeseen costs	5%
Total	100%

If she has R 1800 to spend this month, how much money can she allocate to each expenditure item?

3. Look at the family budget for the month of December 2013, for the Philander family. There are two adults and two children (both in school) in the family.

Item	**Expenditure**		**Income**	**Total income less total cost**
	Fixed	Variable		
Mrs Philander's salary			R 9500	
Mr Philander's salary			a)	
Additional income			b)	
Bond repayment	c)			
Food		d)		
Edgars clothing account payment	e)			
School fees	f)			
Transport		g)		
Entertainment		h)		
Savings	i)			
Car repayment	R 1300			
Municipality rates	j)			
Electricity	R 200	k)		
Vodacom contract cost	l) i.	l) ii.		
Telkom account	m) i.	m) ii.		
Total	?	?	?	?
Surplus or deficit?				?

Complete the above budget of the family by calculating the following:

a) Mr Philander's income: He works 20 days per month at a rate of R 500 per day.

b) Additional income: Mr Philander owns additional property which he hires out to people at a fixed charge of R 2500 per month.

c) The monthly bond repayments are fixed at R 5550 per month.

d) The average amount spent on food each month comes to R 2500. Mrs Philander believes that this should be increased by 10% due to recent food price increases.

e) Mr Philander pays Edgars an amount of R 800 per month,. However, since he bought his children their school uniforms on account, he estimates that this amount will increase by a further 12%.

f) The school fees are R 1200 per child per month.

g) Transport costs are as follows: For the children: taxi fare per child = R 5,00 per trip to school and another R 5,00 each for the trip home. There are 20 school days in a month. Mr Philander first drives his wife to work and then goes to work himself. In the evenings he would pick her up and then drive home again. They both work 20 days per month. Mr Philander has noticed that his car uses an average of 4 litres of petrol per day each time he does this. On the other 10 days of the month, his car uses an average of 3 litres per day. The cost of petrol is R 10,50 per litre. Calculate the total amount that should be budgeted for transport.

h) The amount budgeted for entertainment is estimated at 5% of the combined income of Mr and Mrs Philander.

i) Savings are currently 5% of Mrs Philander's income.

j) The amount budgeted for municipal rates is 5% of the total income earned by the Philander household.

k) The fixed component of the electricity account is currently R 200 per month. The variable component is calculated as follows:The average amount of electricity consumed by the Philander household is 550 kilowatt hours per month at a rate of R 0,50 per kilowatt hour.

l) Vodacom contract cell phone account:

   i. **Fixed component**: R 135 per month

   ii. **Variable component**: R 0,80 per minute of airtime used during peak time. An average of 100 minutes of airtime per month is used during

peak time. Off peak minutes are charged at a rate of R 0,40 per minute. An average of 200 minutes per month is used during this time.

m) Telkom account:

   i. **Fixed component** is R 400 per month.

   ii. **Variable component:** R 0,50 per minute during normal time. An average of 350 minutes is spent each month on the phone during this time. Call more time is calculated at R 7 per night. The children use the phone an average of 20 nights per month during this time.

n) Is the Philander family within budget? Explain your answer.

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1. 24N6 2. 24N7 3. 24N8

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CHAPTER 9

Measurement of perimeter and area

9.1 Introduction and key concepts EMG5Q

Knowing how to calculate the perimeter and area of an object can be useful in many contexts, particularly when we need to know how much of a material we require to do a certain task and how much it's going to cost. Some examples of this are calculating the area of a wall, to ensure we buy the correct quantity of paint, or calculating the perimeter of a vegetable garden, so we know how much fencing we need to order.

In this chapter we will learn how to:

- find the perimeter and area of rectangles, squares, triangles and circles by direct measurement and estimation.
- accurately calculate perimeter and area of rectangles, squares, triangles and circles using formulae.
- solve real-life problems and tasks relating to perimeter, area and cost.

DEFINITION: *Formulae*

The plural of formula. One formula, many formulae.

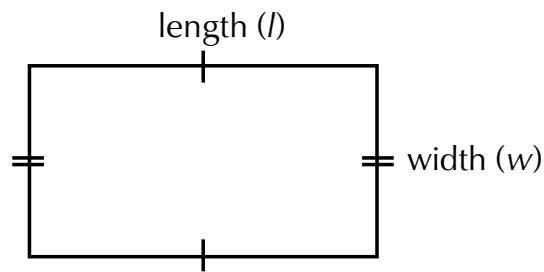
9.2 Measuring perimeter EMG5R

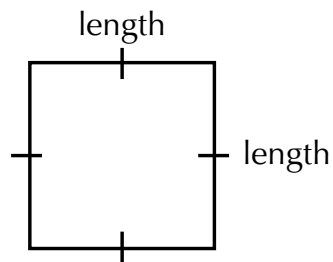
DEFINITION: *Perimeter*

The total length of the outside of a shape or the continuous line forming the boundary of a closed geometric figure. perimeter is measured in mm, cm, m or km.

In this section we will find the perimeter of rectangles, squares and triangles by measuring them directly, and the perimeter of a circle, by estimation. We will not being using any formulae just yet.

DEFINITION: *Rectangle*

A flat two dimensional shape, with both pairs of opposite sides equal in length and all adjacent sides at right-angles (90°) to each other.

DEFINITION: *Square*

A flat, two dimensional shape with all four sides equal in length, and all adjacent sides at right-angles (90°) to each other.

Estimation and direct measurement of perimeter EMG5S

To measure the perimeter of a rectangle, a square or a triangle, we simply measure the length of each side using a ruler and add up the sides to get the perimeter.

To measure the perimeter of a circle, we need to use a piece of string: we can place the string along the outline of the circle, marking off how much string it took to go around the circle once. Then we measure that length of string on a ruler to estimate the perimeter of the circle.

The perimeter of a circle is the same as the **circumference** of the circle.

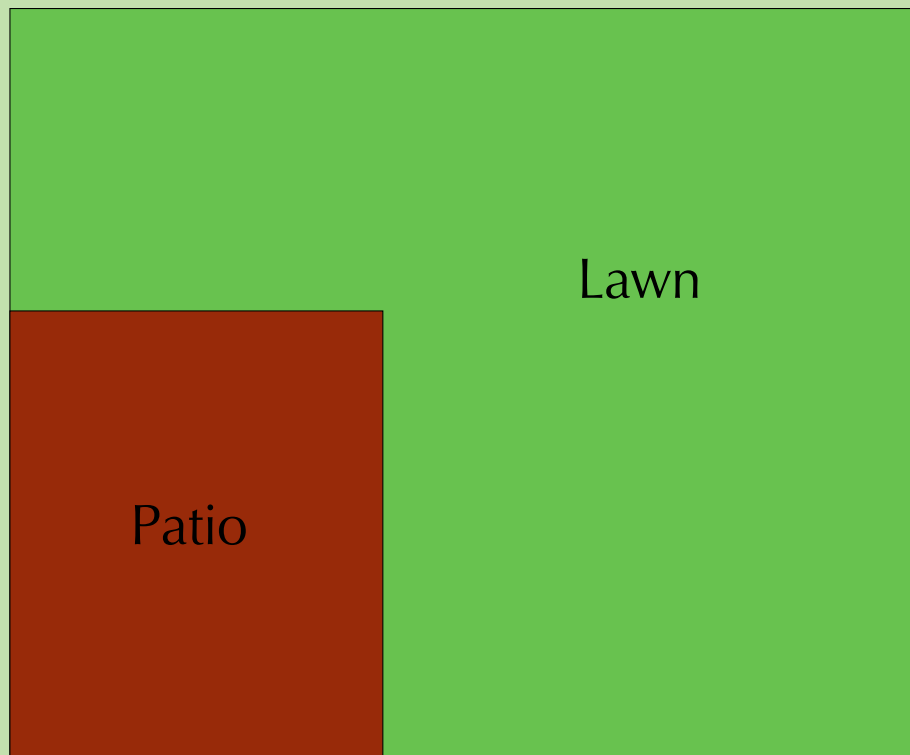
DEFINITION: *Circumference*

The perimeter of a circle or the distance around the curved edge of a circle. Circumference is measured in mm; cm; m or km.

Worked example 1: Measuring the perimeter of a rectangle

QUESTION

Mr and Mrs Dlamini have recently moved into a new house. In the rectangular backyard, the house has a lawn and a rectangular patio as shown in the diagram below.

1. Using a ruler, measure the perimeter (in cm) of Mr and Mrs Dlamini's backyard on the diagram.

2. If the diagram was drawn using a scale of 1 : 100, calculate what the perimeter of the yard is in metres.

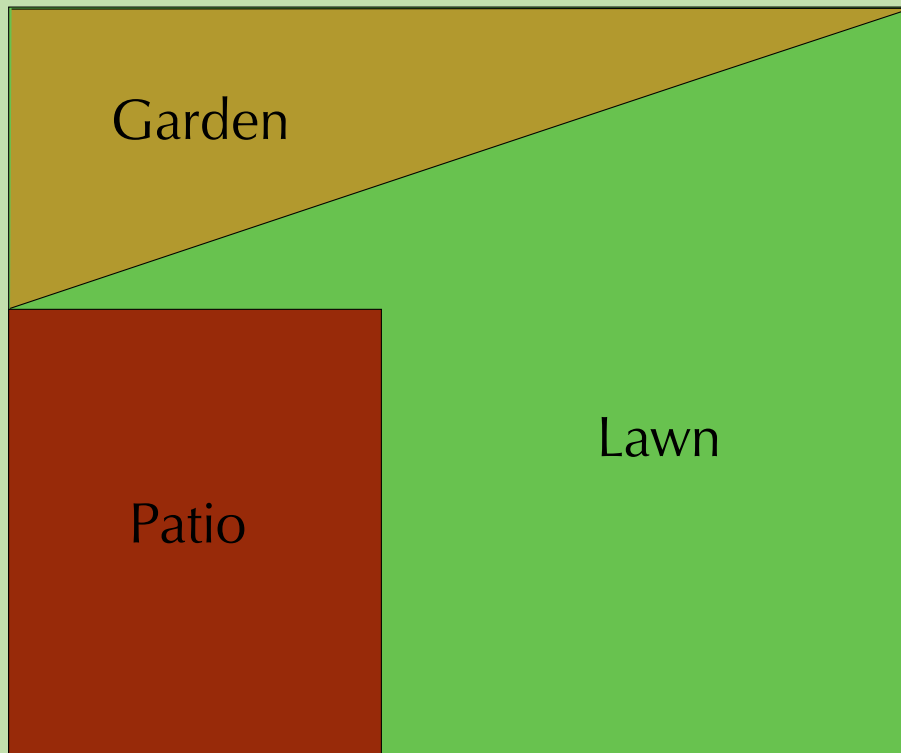
SOLUTION

1. The length of the yard is 12 cm and the width is 10 cm.
   Because the back yard is a rectangle, both pairs of opposite sides are equal in length.
   The perimeter is the total length of the outside of the yard, therefore:
   Perimeter $= 12$ cm $+ 12$ cm $+ 10$ cm $+ 10$ cm
   $= 44$ cm

2. Using the scale of 1 : 100
   Perimeter$= 44$ cm $\times 100 = 4400$ cm $= 44$ m

Worked example 2: Measuring the perimeter of a triangle

QUESTION

Mrs Dlamini wants to dig up some of the lawn and plant a triangular vegetable garden as shown in the diagram below:

1. Using a ruler, measure the perimeter of the triangular garden in the diagram (in cm).
2. If this diagram was drawn using a scale of 1 : 100, calculate the actual perimeter of the garden in metres.

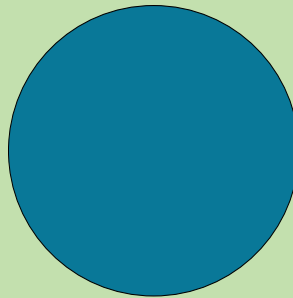
SOLUTION

1. The perimeter of the triangle is 4 cm + 12 cm + 12,7 cm = 28,7 cm
2. Using a scale of 1 : 100
   28,7 cm × 100 = 2870 cm = 28,7 m.

Worked example 3: Estimating the circumference of a circle

QUESTION

Mr Dlamini's hobby is breeding Koi fish. He would like to put a circular pond in the corner of the garden. He would also like to put paving around the fish pond. In order to do this, he needs to calculate the circumference of a circle.

1. Using a piece of string or wool, estimate the circumference of the fish pond shown in the diagram below. You will need to place the string along the outline of the circle, and then measure (in cm) the length of string you used (to form the complete circle) on your ruler. Round your estimated answer off to the nearest centimetre.
2. If the fish pond was drawn using a scale of 1 : 100, what is the actual circumference of the fish pond in metres?

SOLUTION

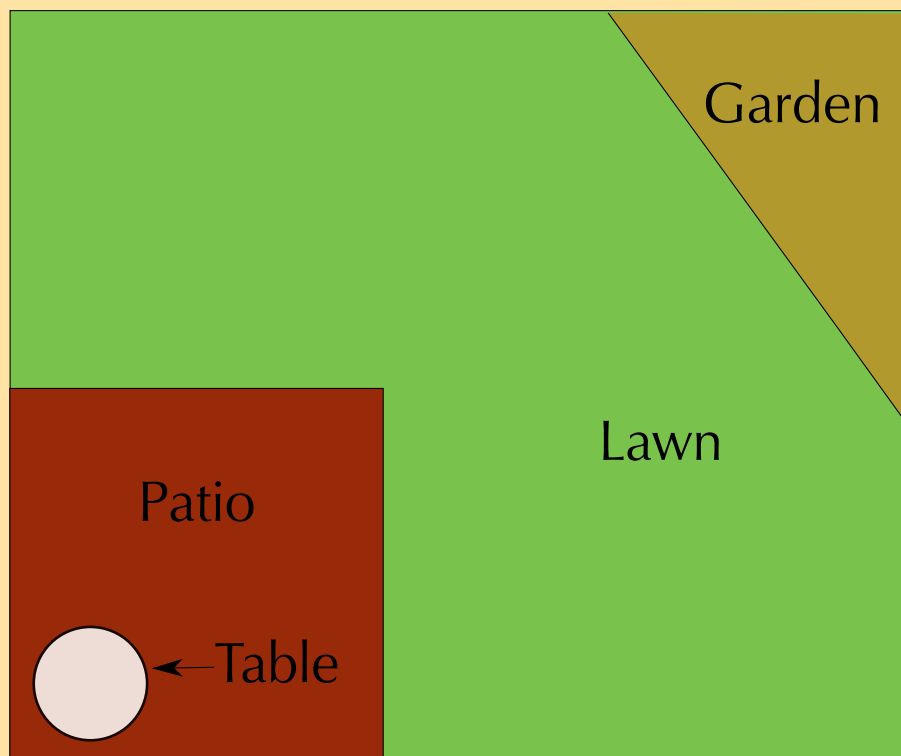
1. Circumference $\approx$ 12 cm
2. Using the scale of 1 : 100

   12 cm $\times$ 100 $=$ 1200 cm $=$ 12 m.

NOTE:
We use the word "estimate" when we have to approximate our answer and we know it will not be exact. In this example it is very tricky to measure the exact circumference of the circle using a piece of string, so our answer is at best an estimation of the measurement.

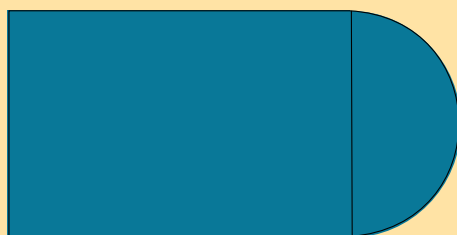
NOTE:
You use the approximately sign ($\approx$) when you are rounding off your answer.

Activity 9 – 1: Measuring and estimating perimeter

1. Study the diagram below and answer the questions that follow:

   a) Before Mr Dlamini builds his fish pond, he decides he wants to make the patio smaller. Using a ruler, measure the new perimeter of the patio on the diagram (in cm)

   b) Mrs Dlamini decides it might be better to build her vegetable garden on the right of the garden because that area gets more sun. Using a ruler, measure the perimeter of the new triangular garden on the diagram (in mm).

   c) Mrs Dlamini also buys a new, circular table for the patio. Using a piece of string and a ruler, estimate the circumference of the table (in mm).

2. Mr Dlamini has two options for the design of his new fish pond. The second option is shown below. Using a ruler and string, measure the dimensions of the new pond (on the diagram) in cm.

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1. 24N9 2. 24NB

Using formulae to calculate perimeter EMG5T

We have learnt how to directly measure perimeter and circumference, but in some cases (like measuring the circumference of a circle using a piece of string) we have seen that it is difficult to be accurate.

There are simple formulae we can use to accurately calculate perimeter and circumference. In order to use these formulae, we need to know certain dimensions of the shape we want to measure.

Shape	Perimeter formula	
Rectangle	$2 \times$ length $+ 2\times$ width	length (l); width (w)
Square	$4\times$ length or $4\times$side	length; length; or; side; side
Triangle	length 1 + length 2 + length 3	1; 2; 3; or; 1; 2; 3
Circle	$\pi \times (2\times$ radius) and/or $\pi\times$ diameter	r; and; d

NOTE:
You will always be given the above formulae in your assessments.

DEFINITION: *Radius*

The radius (r) of a circle is a straight line drawn from the centre to the extreme edge of the circle, or the length of the line from the centre of the circle to any point on its edge.

DEFINITION: *Diameter*

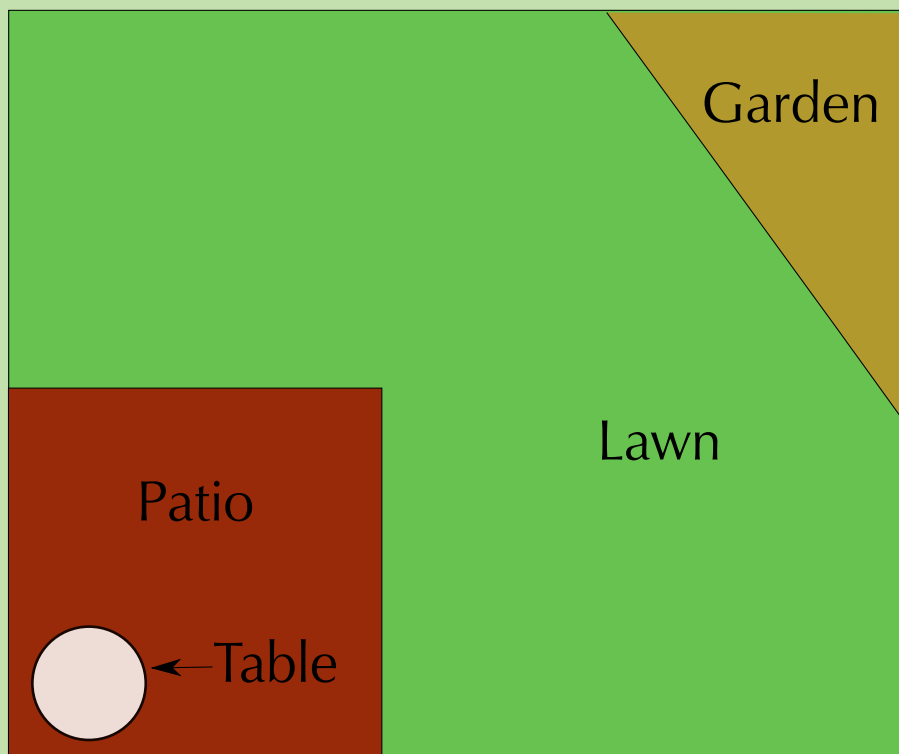
The diameter (d) of a circle is a straight line drawn from one edge of the circle to the other, that passes through the centre of the circle. diameter $= 2 \times$ radius.

DEFINITION: *Pi*

Pi (π) is a special symbol we use when calculating perimeter and area of circles. the value of π is 3,141592645... continuing to infinity. for all of our calculations however, we will use the approximate value of $\pi = 3{,}142$.

Worked example 4: Using formulae to calculate perimeter and circumference

QUESTION

Using the formulae given above, study the diagram below and answer the questions that follow:

1. Calculate the perimeter of the backyard, including the patio (i.e. the whole diagram) (in cm).
2. Calculate the perimeter of the patio (in mm).
3. Calculate the perimeter of Mrs Dlamini's garden (in cm).
4. Calculate the perimeter of the table on the patio (in cm). Round your answer to 1 decimal place.

5. Is your answer to Question 4 different to the table circumference you estimated in the previous activity, using string and a ruler? If it is, discuss why this could be with a friend.

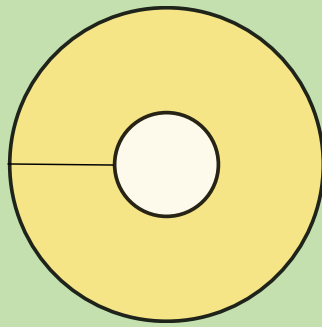
SOLUTION

1. Perimeter of rectangular backyard $= 2 \times$ length $+ 2 \times$ width
   $= (2 \times 12 \text{ cm}) + (2 \times 10 \text{ cm})$
   $= 24 \text{ cm} + 20 \text{ cm}$
   $= 44 \text{ cm}$
2. Perimeter of square patio $= 4 \times$ length
   $= 4\times 5 \text{ cm}$
   $= 20 \text{ cm}$
   $20 \text{ cm} \times 10 = 200 \text{ mm}$
3. Perimeter of triangular garden $=$ length 1 $+$ length 2 $+$ length 3
   $= 4 \text{ cm} + 5{,}5 \text{ cm} + 6{,}8 \text{ cm}$
   $= 16{,}3 \text{ cm}$
4. Circumference of table $= \pi\times$ diameter
   $= \pi\times 1{,}5 \text{ cm}$
   $= 3{,}142\times 1{,}5 \text{ cm}$
   $= 4{,}713 \text{ cm}$
   $\approx 4{,}7 \text{ cm}$
5. Previously, we estimated the circumference of the table using a piece of string and a ruler. You may have gotten an answer closer to 4,5 cm or 5 cm. This is different to our answer here for Question 4 which is 4,7 cm. Using the formula to calculate the circumference of a circle is more accurate that using a piece of string.

The shapes we have worked with so far have been simple. Sometimes we have to calculate the perimeter of a more complicated shape - one that is made up of regular shapes that have been joined together, or one in which the units are not all the same. We will look at how to do this in the next example.

Worked example 5: Using the formula to calculate the perimeter

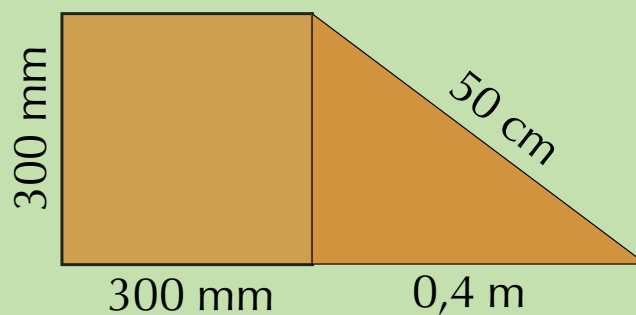
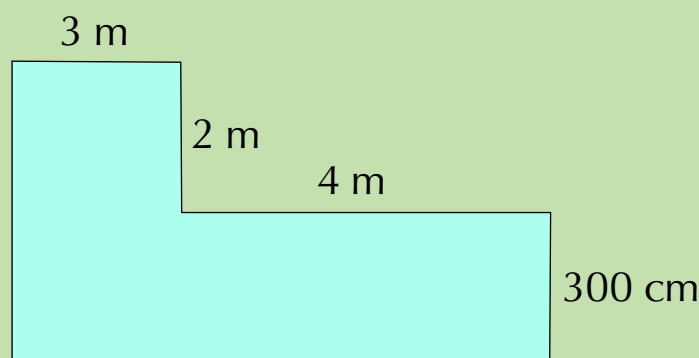
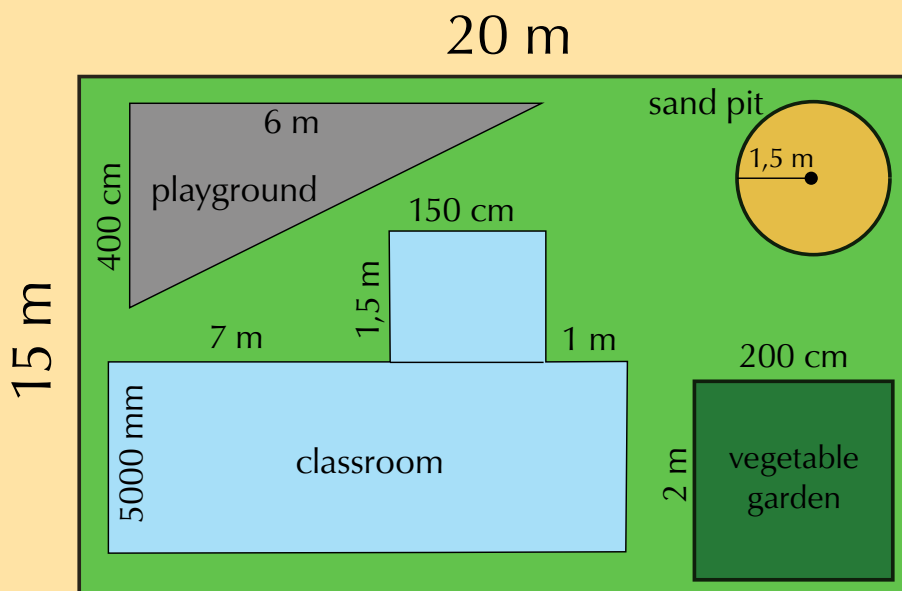
QUESTION

1. Mrs Dlamini buys a new lampshade for a lamp. She measures the radius of the inside circle in the lampshade to be 50 mm. The diameter of the outside (larger) circle is 40 cm. (Note, the diagram is **not** drawn to scale).

a) Calculate the circumference of the smaller, inner circle (in cm).

b) Calculate the circumference of the larger, outer circle (in cm). Round your answer to one decimal place.

c) Calculate the perimeter of half of the larger, outer circle (in cm).

d) Calculate the width of the yellow area, as shown by the dotted line in the diagram above.

2. Mrs Dlamini also buys a new table to put in her lounge. Calculate the perimeter of the table, in metres (the diagram is **not** drawn to scale).

3. The diagram below (**not** drawn to scale) gives the measurements of Mr and Mrs Dlamini's lounge. Calculate the perimeter of the room.

SOLUTION

1. a) Radius = 50 mm = 5 cm
Circumference = $\pi \times (2 \times$ radius)
$= \pi \times (2 \times 5$ cm)
$= 3{,}142 \times 10$ cm
$= 31{,}42$ cm

b) Diameter = 40 cm
Circumference = $\pi \times$ diameter
= $\pi \times$ 40 cm
= 3,142 $\times$ 40 cm
= 125,68 cm
$\approx$ 125,7 cm

c) We know the total circumference of the large, outer circle is 125,7 cm
The perimeter of half of the larger circle is simply the total circumference $\div$ 2:
$\frac{125,7 \text{ cm}}{2} = 62,85$ cm

d) Width of yellow area = radius of large circle − radius of small circle
= $\frac{40}{2}$ cm − 5 cm
= 20 cm − 5 cm
= 15 cm

2. We can see that this complex shape is actually just a square and a triangle. We only measure the outer three sides of the square (which are equal in length), and the outer two sides of the triangle. So:
Perimeter = 3 equal (outer) sides of square + 2 outer sides of triangle
= (3 $\times$ 300 mm) + 50 cm + 0,4 m
First we change all the units to metres and the we calculate the sum of these sides:
Perimeter = (3 $\times$ 0,3 m) + 0,5 m + 0,4 m
= 0,9 m + 0,9 m
= 1,8 m

3. This shape is not as obvious a combination of regular shapes like in the previous question, but we can still easily calculate the perimeter by looking carefully at the dimensions given.
First we change all units to metres, and then we calculate the sum of the sides:
Perimeter = 3 m + 2 m + 4 m + 300 cm + (4 m + 3 m) + (300 cm + 2 m)
= 3 m + 4 m + 4 m + 3 m + (4 m + 3 m) + (3 m + 2 m)
= 26 m

Activity 9 – 2: Using formulae to calculate perimeter

The Inkathalo Nursery School is doing some renovations and improvements to their property. They want to build some new walls and fences and paint some walls, but they need your help calculating the perimeter of these objects so they can calculate how much the improvements are going to cost. They give you a diagram of their school as shown below (**not** drawn to scale). Using the appropriate formula, answer the following questions:

20 m

15 m

6 m
playground
400 cm
sand pit
1,5 m
150 cm
1,5 m
7 m
1 m
200 cm
5000 mm
classroom
2 m
vegetable garden

1. Calculate the following perimeters (in metres):
    a) the playground.
    b) the classroom.
    c) the vegetable garden.
    d) the sand pit (Round your answer to two decimal places).
    e) the entire property (the large, light green rectangle).
2. The school decides to build a low wall around the playground, which they want to paint. They know that 1 ℓ of paint will cover a 50 cm long piece of the wall.
    a) How many litres of paint do they need to buy?
    b) If paint is only sold in 2,5 ℓ tins, how many tins of paint do they need to buy?
3. The school wants to put a new fence around the vegetable garden. They find fencing that is available in 1,5 m long segments.
    a) How many segments will they need to buy in order to fence in the vegetable garden?
    b) If each segment costs R 145,50, how much will the fencing cost them?

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1. 24NC 2. 24ND 3. 24NF

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DEFINITION: *Area*

The size of a surface or plane, or the amount of space inside the boundary of a flat (2 dimensional) object such as a square, triangle or circle. area is measured in mm^2 ; cm^2 ; m^2 or km^2.

Estimating area EMG5W

We can estimate area without using any formulae. One way of doing this is to place a square grid over the area we wish to estimate. If we know the size of the squares, we can then count up how many squares are filled by the area we wish to measure. As we shall see, for some shapes, this method is easy to use and accurate (we would get the same answer for our area as we would using a formula). For other shapes it becomes harder to estimate area accurately however, because they don't fit neatly into a square grid.

Worked example 6: Estimating the area of a rectangle using a grid

QUESTION

Using the grid below, estimate the area (in cm^2) of Mr and Mrs Dlamini's rectangular patio. Each square in the grid is 1 cm by 1 cm.

Patio

SOLUTION

Count the number of blocks and make a mark with your pencil in each one as you count it. This will help you check that you have counted every block.

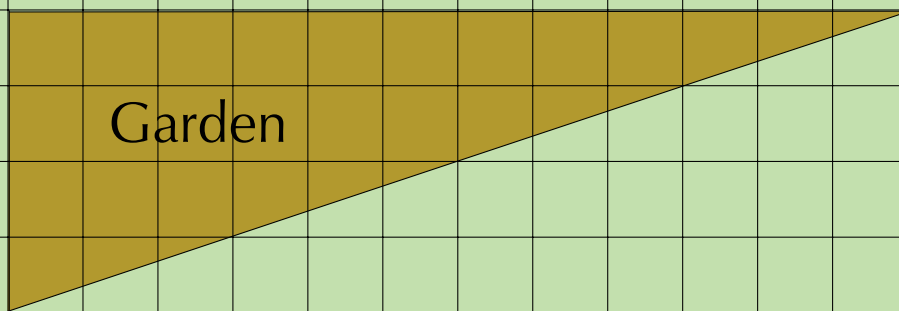
The patio is 5 blocks wide and 6 blocks high.
6 rows of 5 blocks $= 6 \times 5 = 30$ blocks.

Each block is 1 cm^2 so 30 blocks $= 30$ cm^2.

Worked example 7: Estimating the area of a triangle using a grid

QUESTION

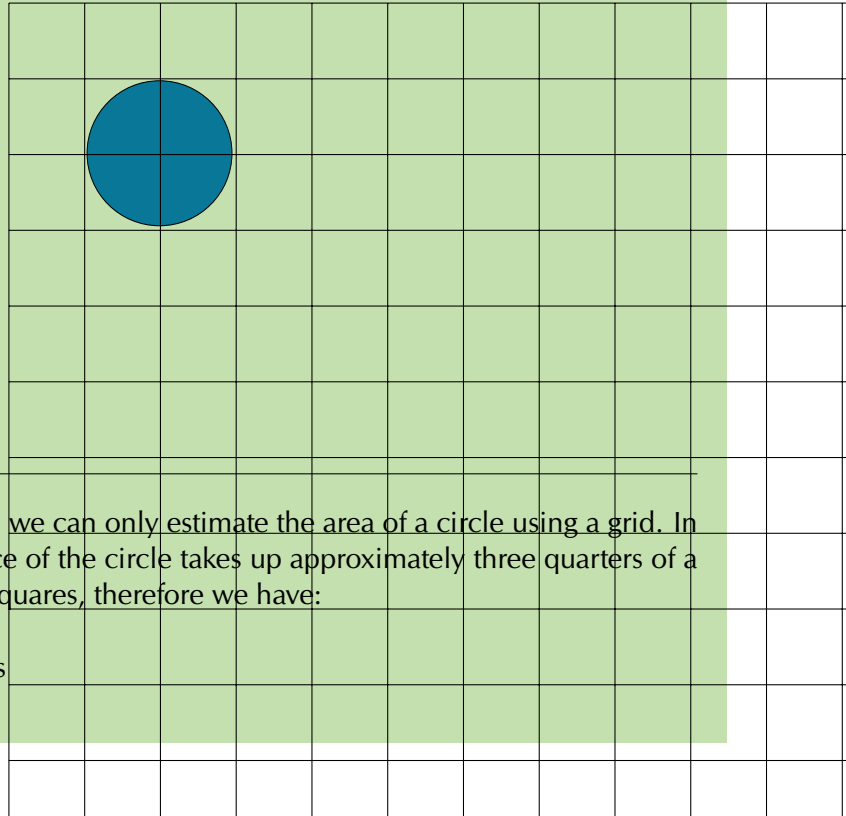
Using the grid below, estimate the area of the triangular garden. Each square in the grid is 1 cm by 1 cm.

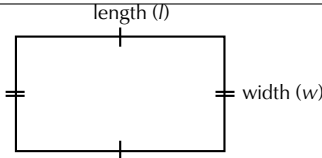
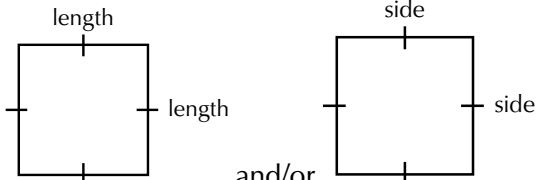
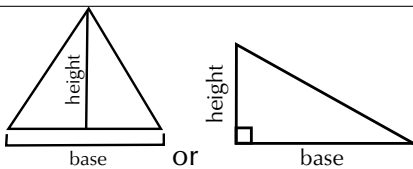
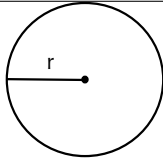
Garden

SOLUTION

- First, count the number of blocks whole blocks that fit inside the triangle.
  There are 18 blocks that are completely inside the perimeter of the triangle.
- Next, count the number of half-blocks that fit inside the triangle, and divide the total by 2.
  There are 4 half-blocks covered by the triangle. This is equivalent to 2 whole blocks.
- Now we count the remaining blocks and estimate how many whole blocks they would make up.
  There are 9 blocks left that are approximately equivalent to $4\frac{1}{2}$ whole blocks.
- Add up the above numbers of blocks: $18 + 2 + 4{,}5 = 24{,}5$ blocks.
  24,5 blocks $=$ 24,5 cm^2

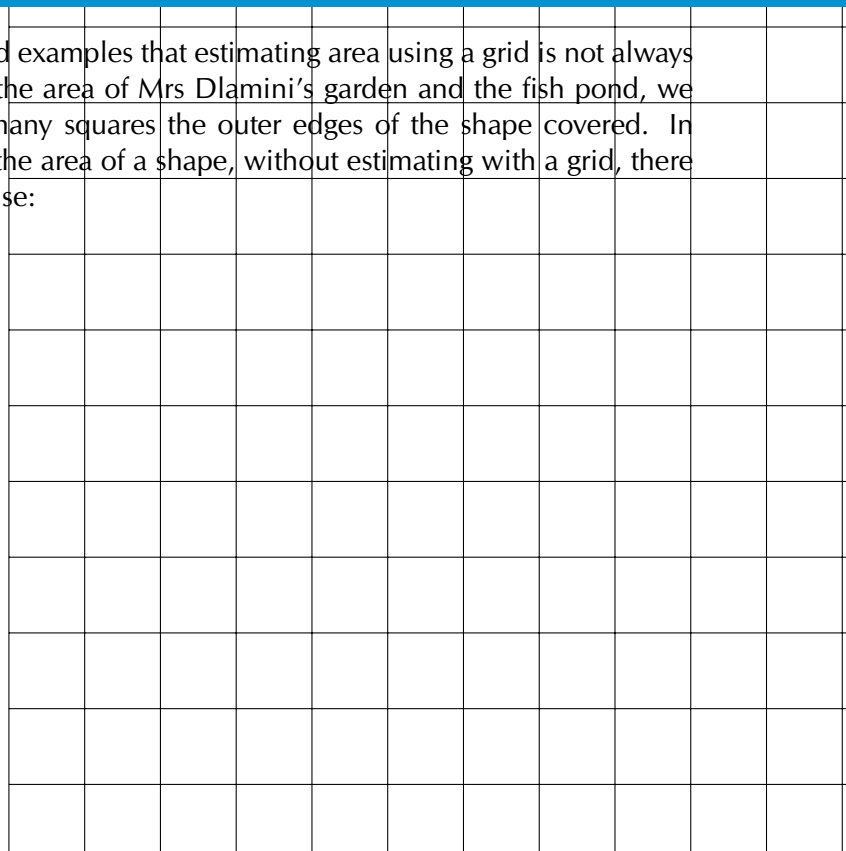
Worked example 8: Measuring and estimating the area of a circle using a grid

QUESTION

Using the grid below, estimate the area of the circular fish pond. Each square in the grid is 1 cm by 1 cm.

SOLUTION

As with the area of a triangle, we can only estimate the area of a circle using a grid. In the above diagram, Each piece of the circle takes up approximately three quarters of a square. There are four such squares, therefore we have:

$\frac{3}{4} \times 4 = \frac{12}{4} = 3$ whole blocks
3 whole blocks $= 3 \text{ cm}^2$

Using formulae to calculate area EMG5X

We saw in the last two worked examples that estimating area using a grid is not always easy or very accurate. With the area of Mrs Dlamini's garden and the fish pond, we were at best guessing how many squares the outer edges of the shape covered. In order to accurately calculate the area of a shape, without estimating with a grid, there are simple formulae we can use:

Shape	Area formula	
Rectangle	length $\times$ width	length (l) width (w)
Square	length $\times$ length $=$ length^2 and/or side $\times$ side $=$ side^2	length length and/or side side
Triangle	$\frac{1}{2} \times$ base $\times$ perpendicular height	height base or height base
Circle	$\pi \times$ radius^2	r

NOTE:
you will always be given the above formulae in your assessments

DEFINITION: *Perpendicular*

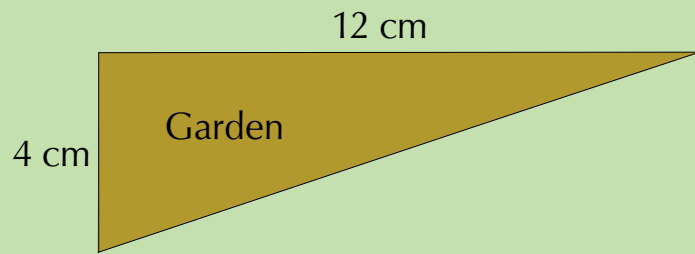
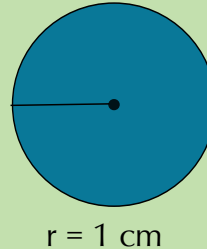
A perpendicular line is straight line that lies at an angle of 90° to a given line, plane, or surface.

Worked example 9: Using formulae to calculate area

QUESTION

1. Using the appropriate formula from the table given, calculate the area of the following three shapes in cm^2 (they are not drawn to scale):

   a)

b)

2. Compare your answers to those you got when estimating the area of the triangular garden and circular pond using a grid. Are they different? If so, why?

SOLUTION

1. a) Area of rectangle $=$ length $\times$ width
   $= 5$ cm $\times$ 6 cm
   $= 30$ cm^2

   b) Area of triangle $= \frac{1}{2}\times$ base $\times$ perpendicular height
   $= \frac{1}{2}\times 4$ cm $\times$ 12 cm
   $= 24$ cm^2

   c) Area of circle $= \pi\times$ radius^2
   $= 3{,}142 \times (1$ cm$)^2$
   $= 3{,}142 \times 1$ cm^2
   $= 3{,}142$ cm^2

2. Our answer for the area of the rectangular patio is the same as our estimated answer using the grid. This is because the patio fitted very neatly into the square grid, and we did not have to guess how many half- or third-blocks were covered.

   When we estimated the area of the triangular garden, using the grid our answer was 24,5 cm^2. This is larger than the answer we got now using the formula, which is 24 cm^2.

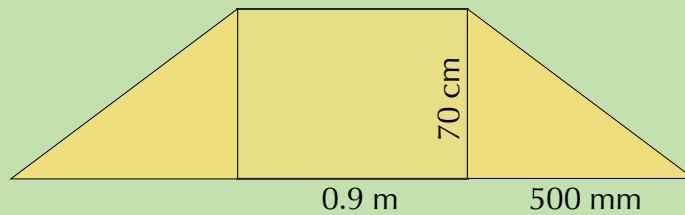
   Similarly, our estimated answer for the area of the circular fish pond was 3 cm^2 which is smaller than the answer we got now using the formula, which is 3,142 cm^2. Using the formulae to calculate area is more accurate than estimating using a grid. It is also simpler in the case of a triangle and a circle!

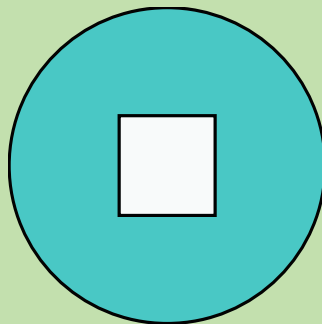
When using formulae to calculate area we will not always be working with regular, simple shapes. Sometimes we will be asked to calculate the area of more complex shapes. In this case, it is easy to solve the problem by breaking down the complex object into smaller shapes, finding the area of each smaller shape, and then adding the individual areas together. The next worked example will show you how to work with such shapes.

Worked example 10: Using formulae to calculate area

QUESTION

1. Your Maths Literacy classroom gets new tables, shaped as shown below.

   a) Using the appropriate formulae, calculate the area of each table, in m^2.

   b) If each table cost R 615,00 and ten tables were bought, calculate how much the tables cost per m^2. (Hint: calculate the total cost of the tables and their total area first).

2. For your birthday, a friend gives you a rare, lucky coin that has a square cut out of the middle as shown in the photo and diagram below:

   a) You measure the diameter of the circle to be 3 cm, and the length of one side of the square to be 0,9 cm. Calculate the area of the coin in cm^2. Round your answer to one decimal place.

   b) If the coin is worth R 3,58 per cm^2, calculate its value.

SOLUTION

1. We can see that the table is made up of two identical triangles, and one rectangle.

   a) • The formula for the area of a triangle is $\frac{1}{2} \times$ base $\times$ height. So the area of one of our triangles is:
   $\frac{1}{2} \times 500 \text{ mm} \times 70 \text{ cm}$
   $= \frac{1}{2} \times 0{,}5 \text{ m} \times 0{,}7 \text{ m}$ (change the units to be metres)
   $= 0{,}175 \text{ m}^2$

- The formula for the area of a rectangle is length $\times$ height, so the area of the middle rectangle is:
  0,9 m $\times$ 70 cm
  = 0,9 m $\times$ 0,7 m (change the units to be metres)
  =0,63 m^2
- Now we simply add the three areas together:
  Area triangle + area rectangle + area triangle
  = 0,175 m^2 + 0,63 m^2 + 0,175 m^2
  = 0,98 m^2

b) 10 tables will cost R 615 $\times$ 10 = R 6150.
10 tables will have a total area of 0,98 m^2 $\times$ 10 = 9,80 m^2

$$\frac{\text{R } 6150}{9{,}80 \text{ m}^2} = \text{R } 627{,}55$$

So the tables cost R 627,55 per square metre.

2. a) To calculate the area of the coin, we need to calculate the area of the circle, and then subtract from this the area of the square cutout.
   - The formula for the area of a circle is $\pi \times$ radius^2.
     We know the diameter is 3 cm, therefore the radius is $\frac{3 \text{ cm}}{2} = 1{,}5$ cm
     Therefore the area of the circle is:
     $\pi \times (1{,}5 \text{ cm})^2$
     = 3,142 $\times$ 2,25 cm^2
     = 7,0695 cm^2
     (Remember, we shouldn't round to one decimal point while we are still busy with our calculations! We should only round our final answer.)
   - The formula for the area of a square is side $\times$ side = $(\text{side})^2$
     Therefore the area of the square is:
     $(0{,}9 \text{ cm})^2 = 0{,}81 \text{ cm}^2$
   - We now subtract the area of the cutout square from the area of the circle:
     7,0695 cm^2 - 0,81 cm^2 = 6,2595 cm^2
     So the area of the coin is 6,2595 $cm^2 \approx$ 6,3 cm^2.

   b) 6,2595 $cm^2 \times$ R 3,58 = R 22,40901 $\approx$ R 22,41.

Activity 9 – 3: Using formulae to calculate area

You did such a good job helping the Inkathalo Nursery School with their perimeter measurements that they ask you to help them with area calculations too. They are planning further major improvements for the school, including new sand, compost for the vegetable garden and carpets in the school building. Using the measurements given on the diagram of the school (**not** drawn to scale), and using an appropriate formula, answer the questions that follow:

1. The school decides to replace the gravel in the playground.

   a) Calculate the area of the playground in m^2.

   b) If one bag of gravel will cover 1,5 m^2, how many bags will they need to buy?

2. The school also needs to order new sand for the sandpit.

   a) Calculate the area of the sandpit in m^2

   b) If one big bag of sand will cover 1 m^2, how many bags do they need to buy?

   c) If a bag of sand costs R 60,75, how much will the sand cost them?

3. The school's gardener decides that they also need buy compost for the vegetable garden.

   a) Calculate the area of the vegetable garden in m^2.

   b) If half a bag of compost will cover 1 m^2 of garden, how many bags do they need to buy?

4. The gardener decides to plant rows of lettuce seedlings in his newly composted garden.

   a) If each row is 2 m long and 50 cm wide, and they are planted right next to each other, how many rows can he plant in the vegetable garden?

   b) If one row of lettuce seeds costs R 12,95, how much will the seeds cost in total?

   c) If the gardener leaves 1 m^2 of space in which to plant carrots, what percentage of the total area of the vegetable garden will be taken up by carrots?

5. Lastly, the school decides they want to tile the floor of the classroom.

   a) Calculate the total floor area of the classroom.

   b) The tiles cost R 73,49 per square metre. How much will the tiling cost in total?

6. The school is renting the property for R 10 000 a month.

    a) Calculate how much they are paying each month, per metre^2 of property.
    b) How much is the school's rent for 1 year?

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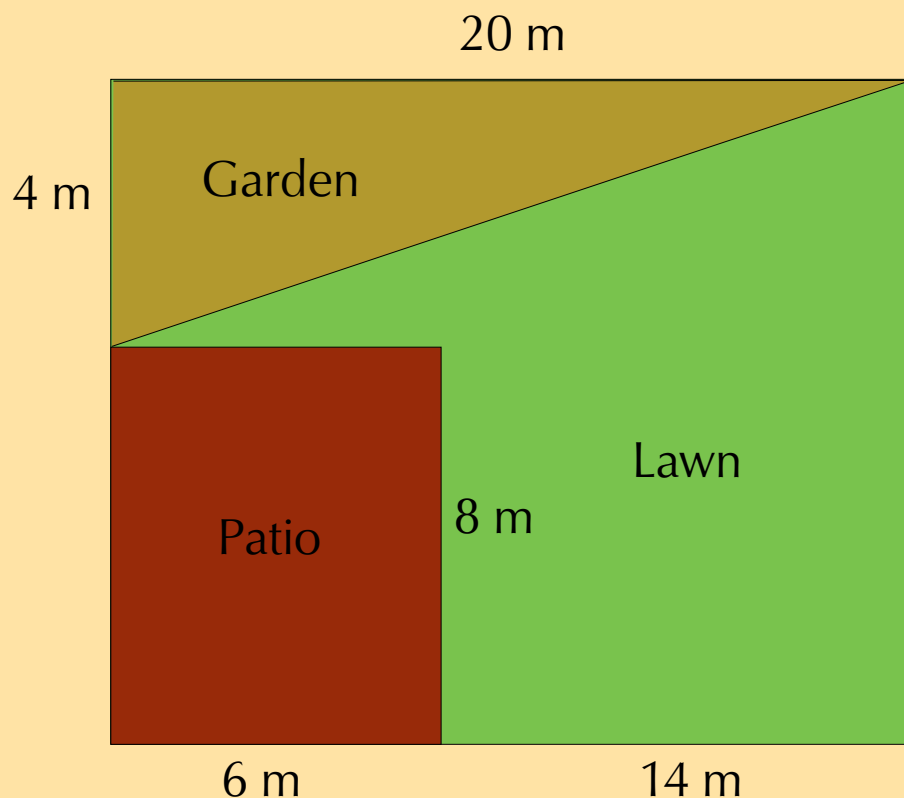
1. 24NG 2. 24NH 3. 24NJ 4. 24NK 5. 24NM 6. 24NN

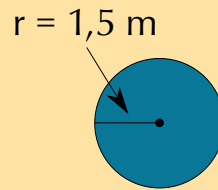
9.4 End of chapter activity EMG5Y

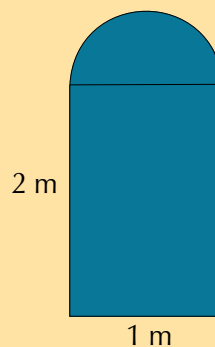
Activity 9 – 4: End of chapter activity

1. Mr and Mrs Dlamini need to make a final decision about their garden and what they are prepared to spend. The diagram below (**not** drawn to scale) shows what their garden currently looks like, with the lawn, patio and garden.

    a) Calculate the area of the property, in metres squared. Use the following formula: Area = length $\times$ width.
    b) Calculate the area of the garden (indicated on the diagram) using the following formula: Area = $\frac{1}{2}\times$ base $\times$ perpendicular height.

c) What percentage of the area of the whole property is the triangular garden? Express your answer as a whole number.

2. Mr Dlamini still has not decided on a shape for his new fish pond.

   a) One option is for Mr Dlamini to install a circular fish pond with a radius of 1,5 m, as shown in the diagram:

   Calculate the area of this pond in metres squared, using the formula: Area $= \pi \times$ radius^2, where $\pi = 3{,}142$.

   b) The alternative design for the fish pond, as we have already seen looks as follows:

   Using the dimensions given on the diagram above, calculate the area of the other possible fish pond using the formulae Area $= \pi \times$ radius^2 and Area $=$length $\times$ width, where $\pi = 3{,}142$.

   c) How does your answer to b) compare to the area of the circular fish pond that we calculated in a)? Which shape of fish pond should Mr Dlamini choose if he is worried about the pond taking up too much space in his garden? Give reasons for your answer.

3. Mr Dlamini is concerned that his dog will try to climb into the fish pond once it's built. He will need to put a fence around the fish pond. He has still not decided which style of fish pond he wants to build. He decides to get quotes from a fencing company called "Fence-Me-In". They give him the following information:

   a) Labour costs: R 549,99 for the whole project

   b) 1 metre of fencing costs R 29,99.

   Calculate the total cost for each style of pond.

4. Based on your answers to Questions 2 c) and d), which style of fish pond do you think Mr Dlamini should choose? Give reasons for your answer.

5. The Dlamini's are also wanting to redo the paving of the patio, and replace the bricks with cobblestones. The actual dimensions of the patio are as follows: length $=$ 6 m and width $=$ 8 m.

Figure 9.1: Cobblestone paving

a) If the dimensions of **one** cobblestone is 10 cm by 10 cm, how many cobble stones will be needed to pave the patio? (Hint: convert all units to be the same!)

b) Cobblestones are sold in batches of 200. How many batches will be needed to be bought?

c) If one batch costs R 129,99, what will be the **total** cost of the cobblestones?

6. Sam's uncle works for a company that puts up safety fences around swimming pools, and nets over swimming pools. He must calculate how much fencing and netting they need for each of the swimming pools shown below. The fencing is always 1 metre away from the swimming pool. For each swimming pool below, calculate:

   i. the perimeter of the swimming pool.

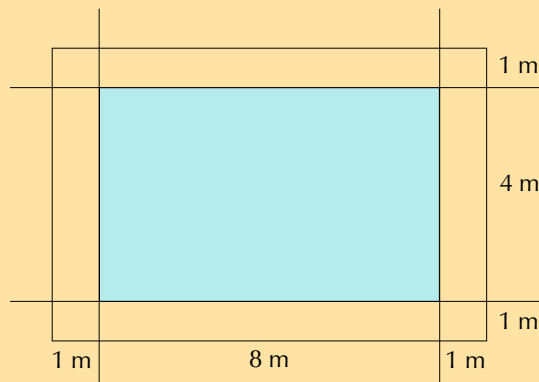
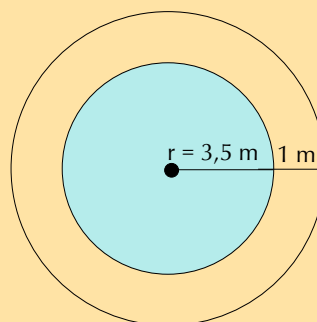
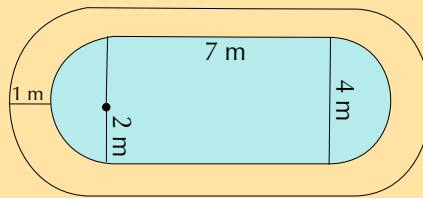
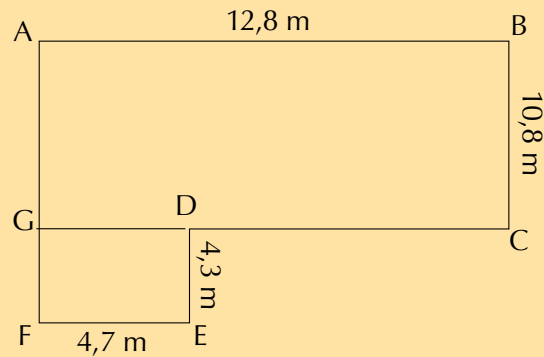
   ii. the length of fencing needed.

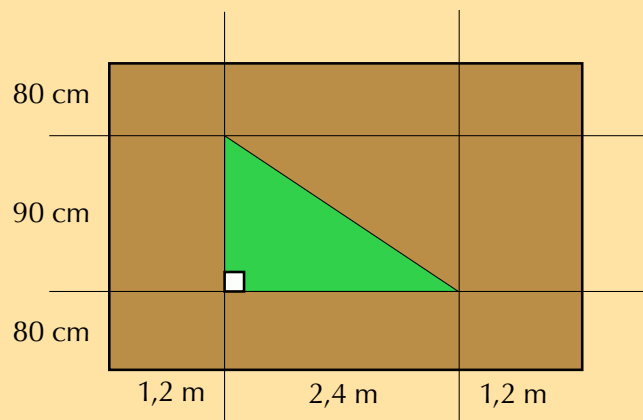
   iii. the area of the swimming pool (the area of netting needed).

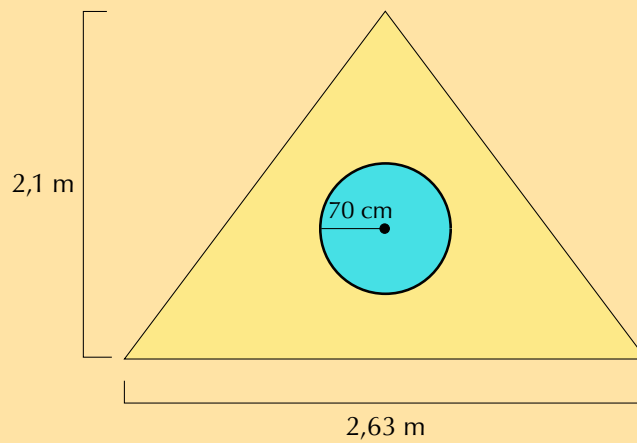
   iv. the cost of the fence at R 250,00 per metre.

   v. the cost of the netting at R 199,99 per m^2.

   Round all of your answers to two decimal places.

   a)

   b)

c)

7. Below is the plan of Phumza's property. Homeowners pay rates to the municipality which are calculated according to the area of the property.

   a) Calculate the area of this house. Round your answer to the nearest whole metre.
   b) The basic municipal rate is calculated using the following formula:
      R 15,05 per m^2 of the property per year.
      What would Phumza's **monthly** rate bill be?

8. Lebo wants to put paving around her new, triangular vegetable garden as shown in the diagram:

   a) What is the area of the vegetable garden in metres squared?
   b) What is the area of the paving, in metres squared? (excluding he vegetable garden!)
   c) If the paving is going to cost R 24,65 per metre squared, how much will the total cost of the paving be?
   d) Lebo wants to build a fence around her garden. To do this, she needs to calculate the perimeter of the triangular garden. Is this possible with the information provided in the diagram? Explain your answer.

9. As a decorative feature, Jan builds a round window into the attic of his house.

a) Jan needs to paint the triangular wall around the window. What is the area of the triangular piece of wall in m^2? (Use the formula: Area $= \frac{1}{2} \times$ base $\times$ height)

b) Assume it takes 1 litre of paint to cover 0,5 m^2 of wall. How many litres of paint will Jan need to buy?

c) If the hardware store only sells paint in 2 litre tins, how many tins will Jan need to buy?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24NP 2. 24NQ 3. 24NR 4. 24NS 5. 24NT 6. 24NV
7. 24NW 8. 24NX 9. 24NY

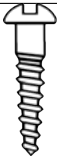
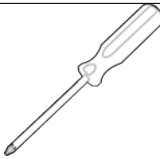
CHAPTER

Assembly diagrams, floor plans and packaging

10.1 Introduction and key concepts EMG5Z

In Chapter 6 you learnt about scale, maps and seating plans. In this chapter you will learn about floor plans in greater detail. You will also learn how to:

- read instructions and use assembly diagrams to put together objects like a cell phone, plugs and simple pieces of furniture.
- work with rough and scaled floor plans, understand the symbols and notation used on plans and to determine what the scaled dimensions of an object should be (on a plan) when you're given the actual dimensions.
- understand models and packaging by investigating packaging arrangements using actual cans and boxes, in order to determine the most appropriate and cost effective ways to pack these items.

10.2 Assembly diagrams EMG62

When you buy certain items from a shop, for example a piece of furniture, sometimes the item is not fully assembled. You would then have to assemble the item yourself. These items usually come with a set of instructions and/or an annotated diagram.

When we refer to "instructions for assembling", we are referring to words (usually short sentences) describing how to assemble an item. When we refer to "assembly diagrams", we are referring to annotated (labelled) pictures that explain in detail how we must assemble an item.

It is vital to ensure that you know what each symbol in the assembly instructions mean.

Some symbols you might see include:

Worked example 1: Reading assembly instructions

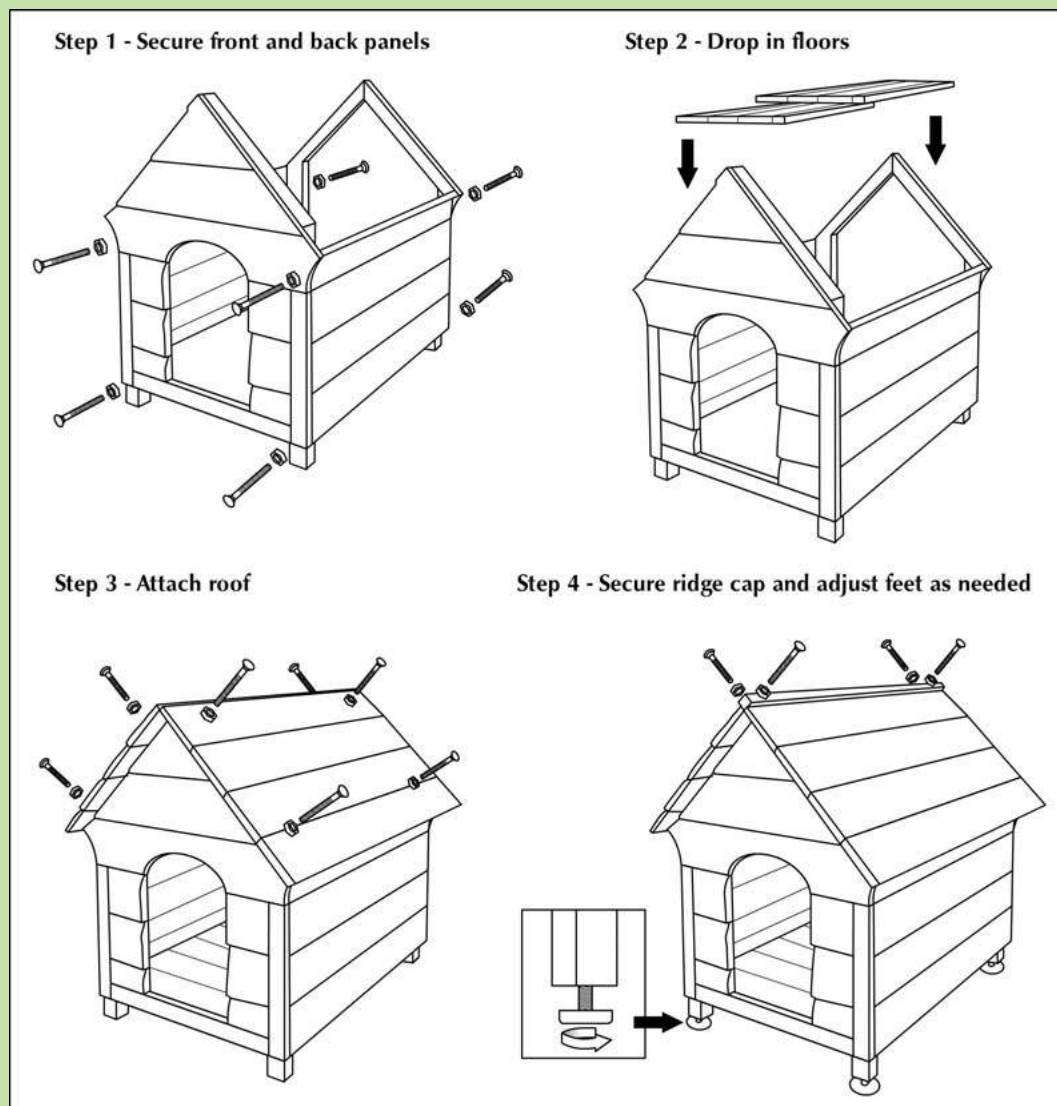
QUESTION

Study the assembly diagram below and describe (in words) each step of assembling this dog kennel in detail.

Step 1 - Secure front and back panels

Step 2 - Drop in floors

Step 3 - Attach roof

Step 4 - Secure ridge cap and adjust feet as needed

SOLUTION

In this assembly diagram, we are given instructions in words and pictures.

Step 1: The diagram shows that we need to align the front, sides and back of the kennel as shown, and screw in the front and back panels (the screws may or may not be provided with the kennel, we cannot know this from the instructions alone).

Step 2: Once we have secured the front and sides of the kennel, we put in the floor of the kennel by inserting it from the top. According to the diagram, the floor does not need screws to be held in place, it should simply fit inside.

Step 3: Now we need to attach the roof. According to the diagram, this requires 8 screws to be placed in the positions indicated on the roof of the kennel.

Step 4: Last, we screw in the top piece of the roof (the "ridge cap") with four screws, and adjust the feet of the kennel to make it level. As shown in the inset diagram, to adjust the feet we can turn the base of each foot like a screw.

Assembly diagrams don't always come with written instructions. Sometimes we are only given pictures (e.g. to avoid having to translate instructions into different languages), or sometimes only written words. Either way, you need to be able to interpret the instructions and make sense of them.

Worked example 2: Understanding assembly instructions

QUESTION

In the image on the opposite page, instructions are given in picture form only. Each blue number on the diagram represents one step in the assembly process. You are given five written instructions below. In the table that follows, match each written step to the step number you think it describes:

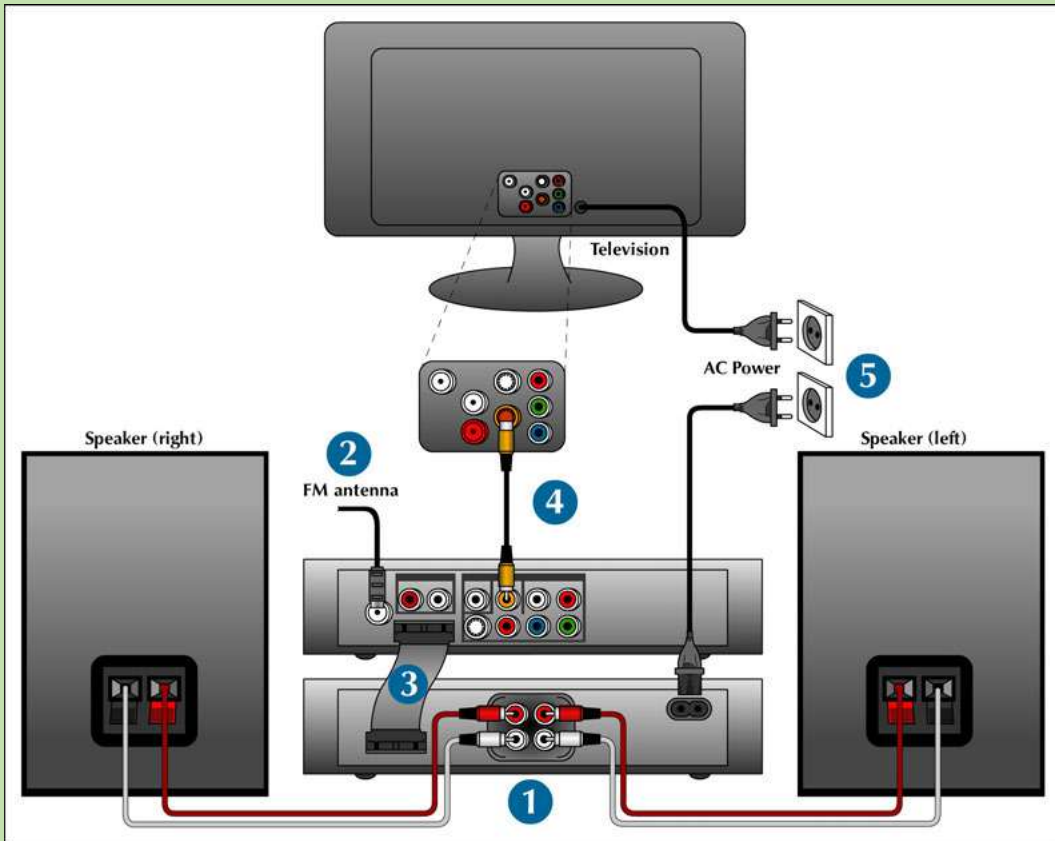
a) Connect the composite video cable to a TV.

b) Connect the speaker cables.

c) Connect the power cables of the system and TV.

d) Connect the control cable.

e) Connect the FM antenna.

Step number on image	Statement number/description
1	
2	
3	
4	
5	

SOLUTION

Step number on image	Statement number/description
1	b) Connect the speaker cables
2	e) Connect the FM antenna
3	d) Connect the control cable
4	a) Connect the composite video cable to a TV
5	c) Connect the power cables of the system and TV

Worked example 3: Writing assembly instructions

QUESTION

In a group, study the images below showing how to insert a cell phone's SIM card and battery, and write a description of each step, based on the images.

SOLUTION

Step 1:

Place your fingernail in the cover release opening, lift the back cover of the phone up (1) and pull it back (2) to remove it.

Step 2:

Lift out the battery by slipping your finger under the side and lifting it up (1) and out (2) of the phone.

Step 3:

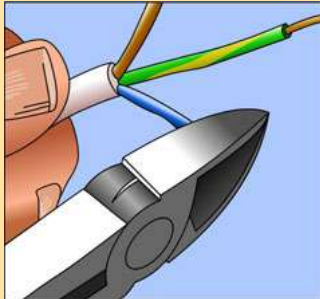
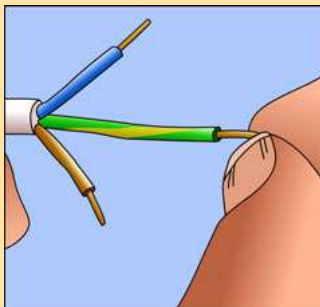
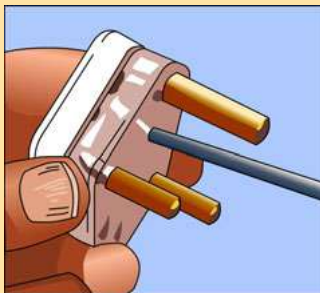
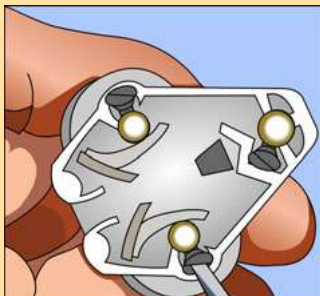
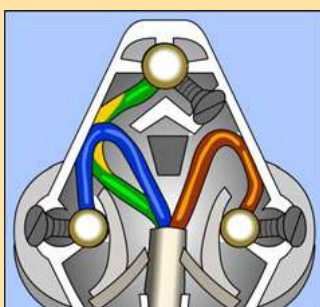
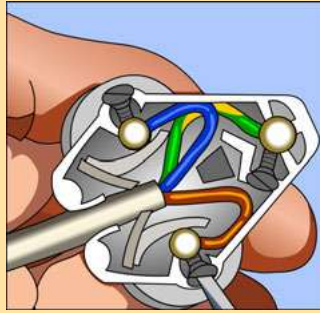
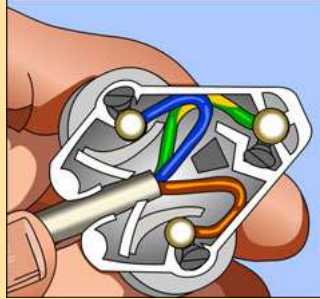
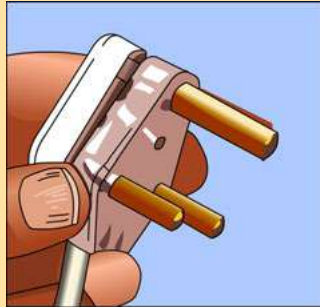
Slide the SIM card into the SIM card socket inside the phone. Make sure that the card's gold contacts face downwards.

Step 4:

Replace the battery by slipping it back into the phone and (1) pressing it down and down (2)

Activity 10 – 1: Wiring a plug

Study the assembly instructions given below to wire a plug and answer the questions that follow.

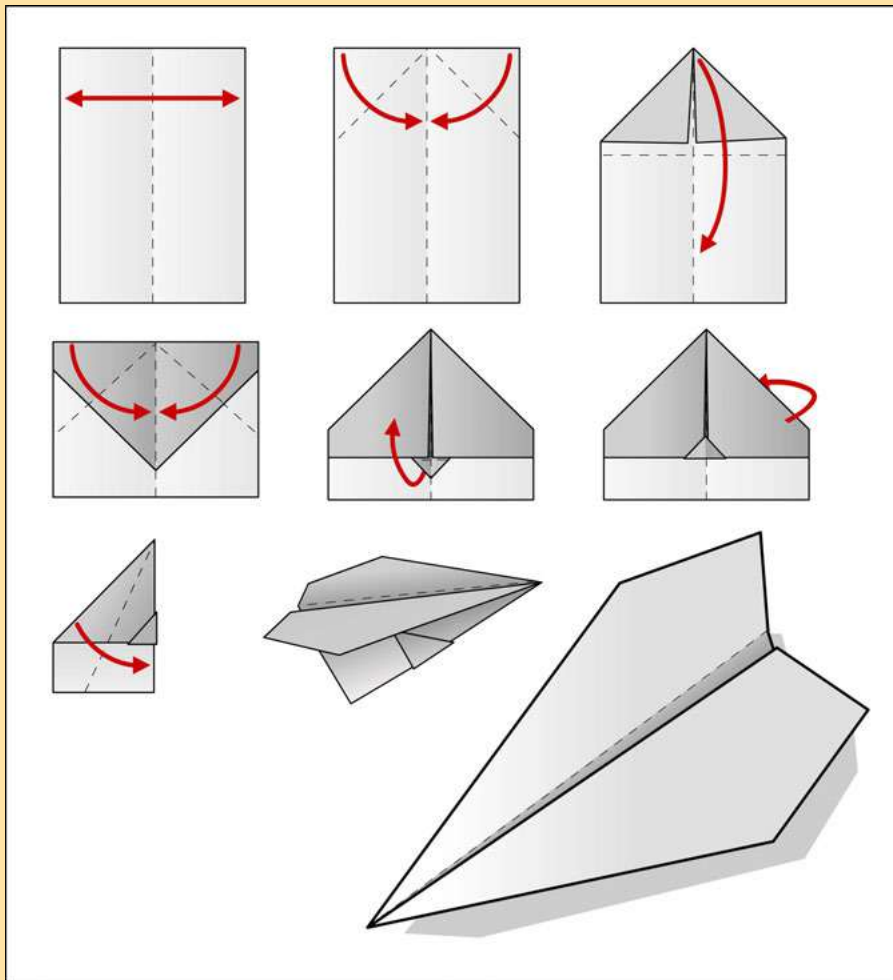
NOTE:
Do not attempt to wire a plug yourself unless you are supervised by an adult who knows how to do it correctly! Electrical appliances can kill you if they are not properly wired!

1. Using pliers, carefully bare the ends of the three wires inside the electrical cord for about half a centimeter, by cutting away the plastic insulation.

2. Gently twist the strands of copper wire with your fingers until each strand is tight.

3. Remove the new plug cover by either "snapping" it open or unscrewing it.

4. Unscrew the little screws on each of the plug's prongs.

5. Insert the twisted copper wires into the holes in the prongs. The green and yellow wire must **always** be inserted into the top (largest) prong.
The blue wire is inserted into the left prong (sometimes marked with a blue spot or the letter N).
The brown wire is inserted into the right prong (sometimes marked with a brown spot or the letter L)

6. Tighten the little screw on each of the plug's prongs.

7. Make sure the electrical cord is firmly gripped by the arrester clips at the bottom of the plug.

8. Replace the cover of the plug.

1. What colour wire must be inserted into the top prong?
2. What colour wire must be inserted into the left prong?
3. What colour wire must be inserted into the right prong?
4. What is the main difference between a 2 prong plug and a 3 prong plug?
5. Why do you think it important to wire an electrical appliance correctly?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24NZ 2. 24P2 3. 24P3 4. 24P4 5. 24P5

Activity 10 – 2: Making a paper glider

In a group, follow the instructions given below to make a paper glider and answer the questions that follow.

1. For each step, write down a description of what you had to do.
2. Write down one advantage and one disadvantage of instructions without words.
3. Do all the paper gliders made by your class look the same? What could have been added to the diagrams to ensure that they all look the same?
4. Can you think of a better design for a paper glider? Experiment with your glider and see if there are other ways you could assemble it.
5. Write assembly instructions and draw diagrams to explain how to make your new and improved paper glider.

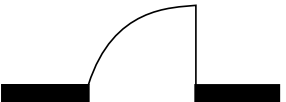
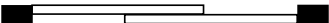
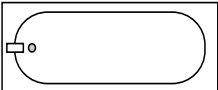
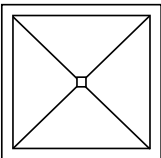
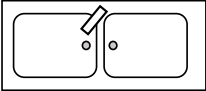
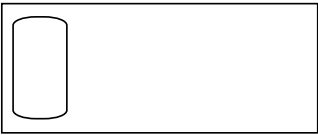
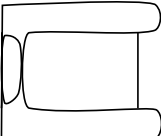
Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24P6 2. 24P7 3. 24P8 4. 24P9 5. 24PB

10.3 Floor plans EMG63

We have already worked with floor plans in Chapter 6. In this section we will learn about them in more detail.

To recap what we already know:

- A plan is a 2 dimensional picture or drawing that describes what an object looks like and the dimensions of the object.
- Plans can be drawn to show different views of an object.
- Plans can involve the use of a scale. This scale is used to find the actual size (real life size) of certain objects within the plan.

There are three main types of plans, namely: floor or layout plans, elevation plans and design plans. Floor plans are plans showing the layout of buildings or structures seen from a top view (from above). Elevation plans show what an object looks like from different side views. Design plans are commonly used in the fashion and design industry. The plans are often of clothing items that will be sent to the manufacturers. In Grade 10, you only need to understand how to work with floor plans.

A floor plan is also known as a layout plan. It shows an object as seen from above, as if you have taken off the roof of the building/structure to look inside. In Grade 10 we will only work with two dimensional plans showing the dimensions for length and width.

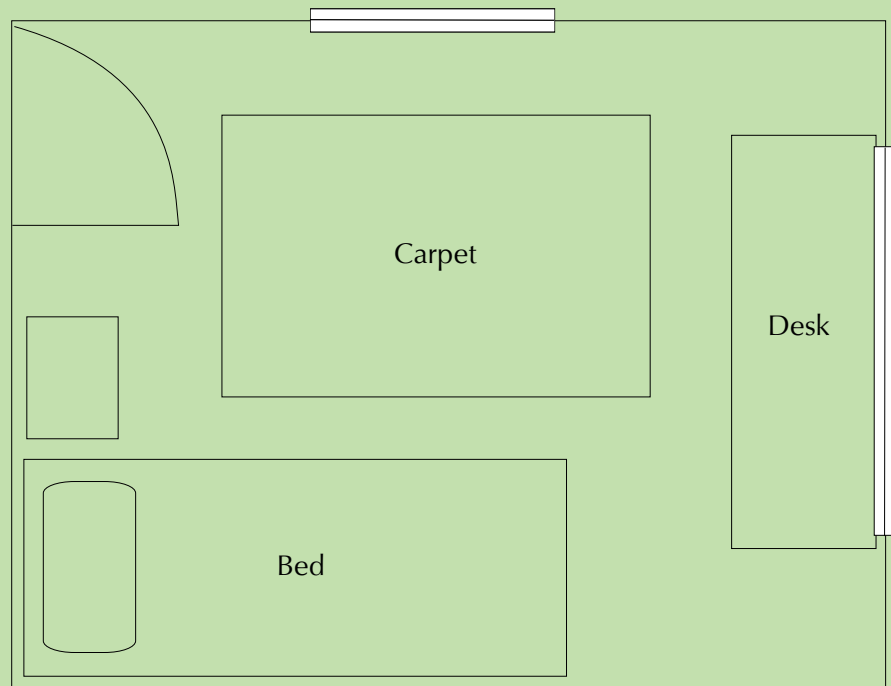
Understanding floor plan symbols EMG64

It is important to understand the layout of floor plans. In order to do this, one can use a key (or legend) that would portray the symbols (and their names) most commonly used on floor plans.

The picture on the next page shows the symbols most commonly used in a floor plan.

Solid wall
Wall that does not reach the ceiling
Window in a wall
Door, indicating which way it opens
Sliding door
Bath
Toilet
Shower
Double kitchen sink
Single bed
Single armchair

Worked example 4: Reading a floor plan

QUESTION

1. What kind of room is this?
2. How many doors does the room have?
3. How many windows does the room have?
4. Why is the desk in front of the window?
5. Is there an alternative position for the bed if the bed may not be in front of a window? Explain your answer.
6. Which items would need to be removed from the room if the single bed was exchanged for a double bed?
7. Explain why the symbol for a door is a quarter circle.

SOLUTION

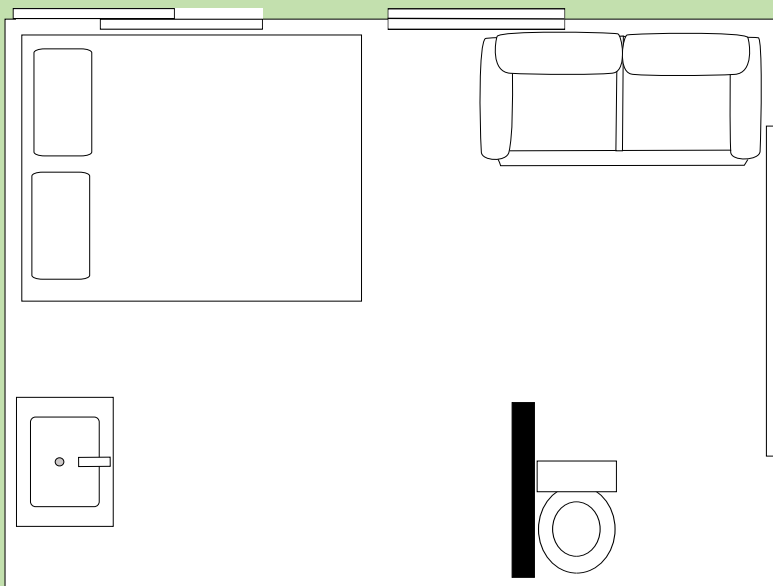
1. A bedroom
2. One door
3. Two windows
4. The window lets in light which means that the person sitting at the desk will be able to work or study without putting strain on their eyes.
5. No, the current position is the only one where the bed is not in front of a window. The bed is too wide or too long to fit against the other walls.
6. The bedside cabinet.

7. This shows the space needed for the door to open. It helps to ensure that no furniture is placed in such a way that the door won't open.

Understanding floor plan layout EMG65

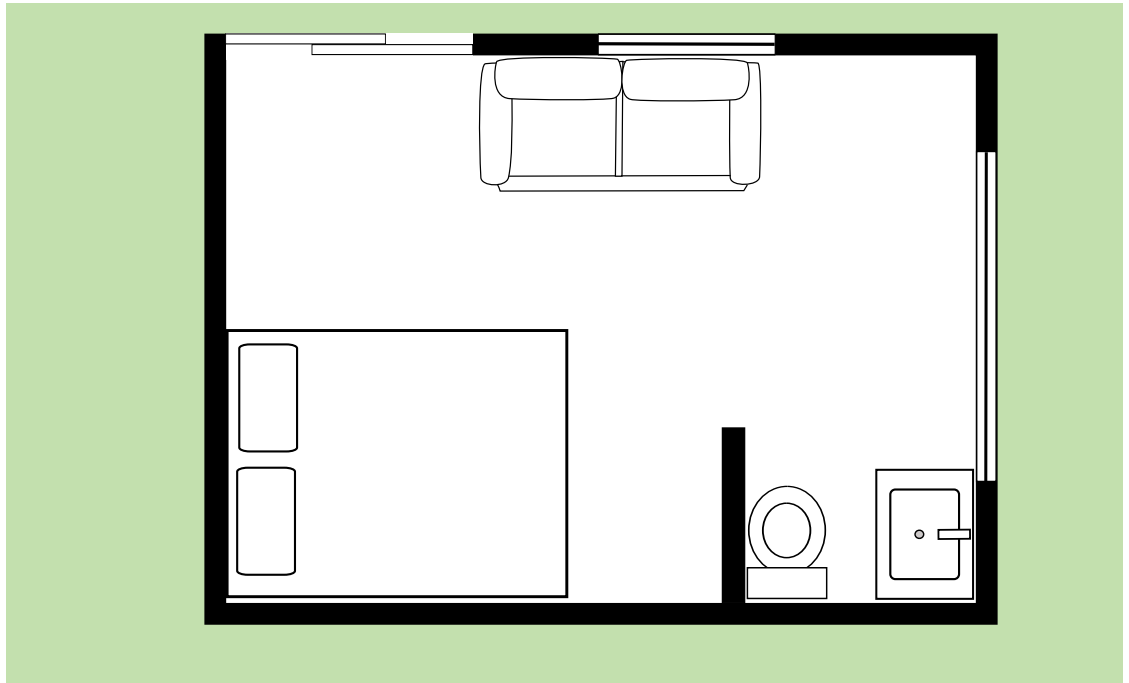
In this section we will learn how to describe what is being represented on a plan, to analyse the layout of the structure show on the plan and suggest alternative layouts.

Worked example 5: Understanding floor layout

QUESTION

The room above has some serious design flaws.

1. Identify 4 problem areas in the diagram. Motivate your answer.
2. Redraw the floor plan with an improved layout. Include all the elements from the original plan.

SOLUTION

1. The bed is directly in front of the door. The basin is facing the wrong way. The toilet is not attached to a wall. The toilet is almost impossible to use. The couch faces into the bathroom area.
2.

Activity 10 – 3: Understanding floor layout

1. The following diagrams show two different kitchen layouts. The arrows on the diagrams indicate the movements required to cook dinner, which includes meat, vegetables, a starch (potatoes or rice) and a salad.

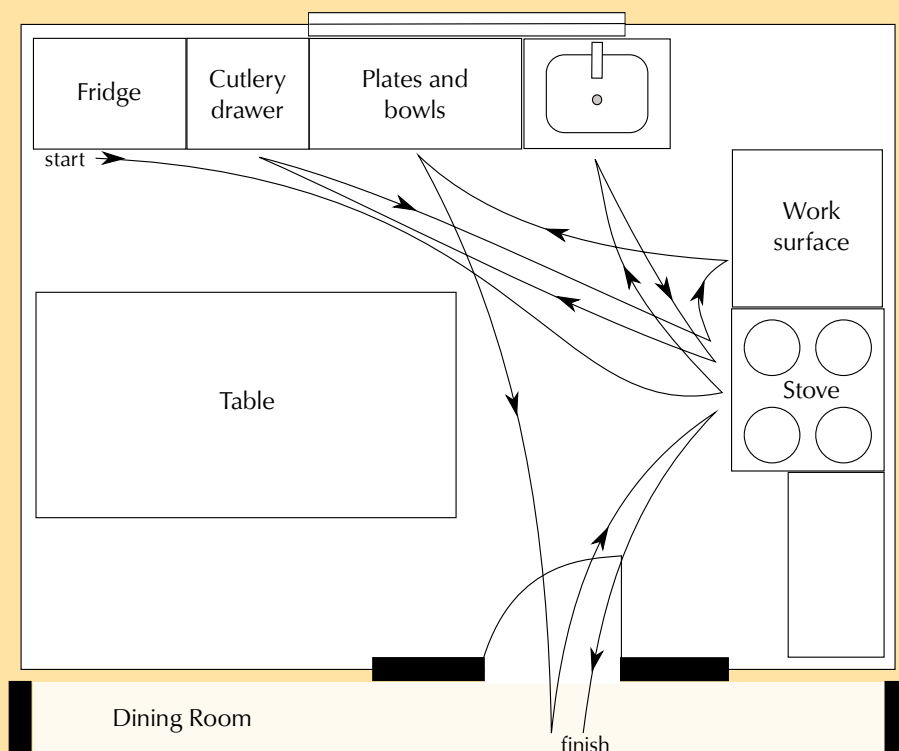



Figure 10.1: Diagram 1

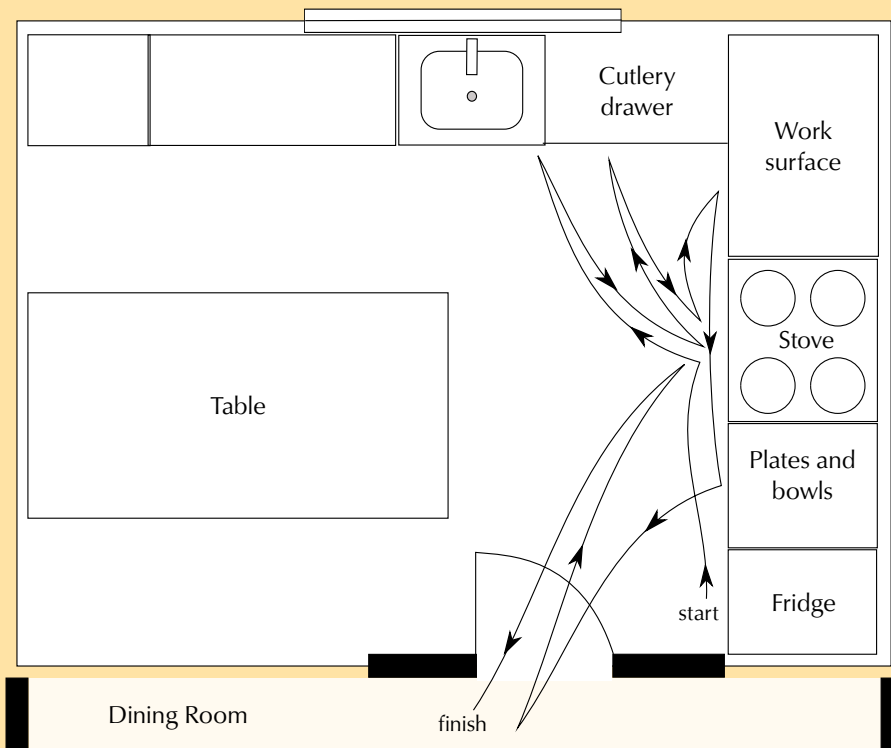



Figure 10.2: Diagram 2

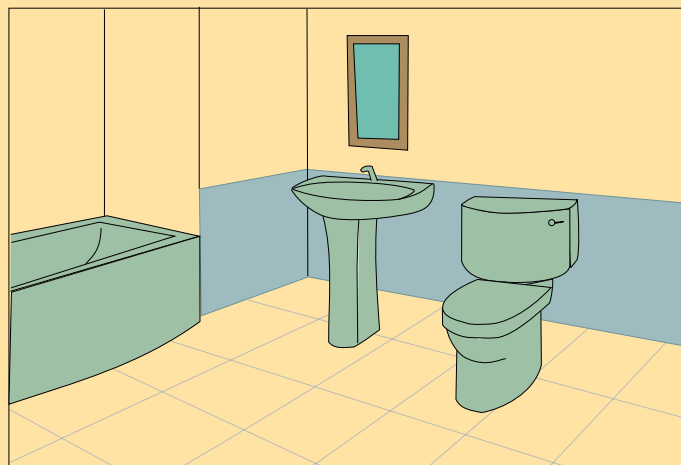
a) Compare the direction that the door opens for Diagram 1 and Diagram 2. Why would the direction that the door opens in be better in Diagram 2 than in Diagram 1?

b) Why is the stove not placed under the window in either diagram?

c) Which layout is better when you are cooking food? Give reasons for your answer.

d) Which layout is better when you are washing dishes and cleaning up after dinner? Give reasons for your answer.

e) Design your own kitchen that will keep the distance you have to walk to a minimum when cooking and cleaning up. Your kitchen has to have the same elements in it as are found in the diagrams.

2.

a) Draw a rough floor plan of the room in the illustration. Use the symbols given above at the beginning of this chapter. The plan does not have to be

to scale but the relative size of the contents must be accurate. Add a door to your floorplan in any place you think is appropriate.

b) There are no windows shown on the diagram. The two walls that aren't visible in the illustration are inside the house. Where would you place a window? Provide reasons for your answer.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24PC 2. 24PD

Working with scale on floor plans EMG66

In order to be able to calculate the dimensions of an object on a scale or map you must be able to work with scale. We learnt about the number and bar scales in Chapter 6. We will continue to work with them in this section.

Worked example 6: Working with scaled floor plans

QUESTION

Your school is building a new classroom. The measurements of the classroom are as follows:

Length of the walls: 5 metres

Width of the door: 810 mm

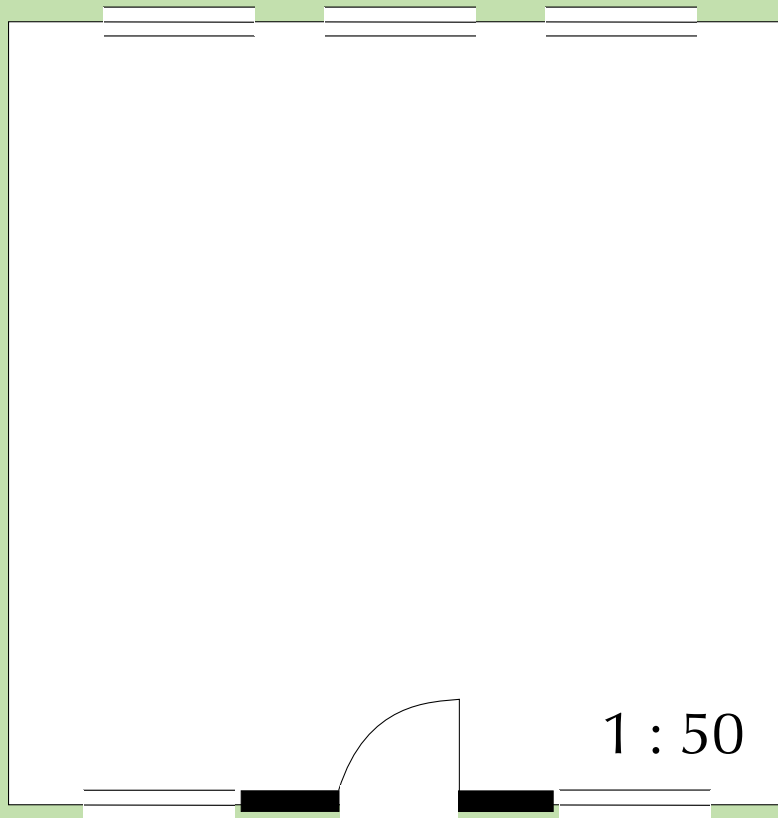
Width of the windows: 1000 mm

1. You have to draw a plan of the classroom using a scale of 1 : 50. You have to place a door and 2 windows in one of the walls. Another wall must have 3 windows. Two walls have no windows.Use the appropriate symbols in your plan.
2. If the school wants to make blinds out of fabric for the classroom windows, and the blinds are the same size as the windows (1000 mm wide), calculate the total length of material (in metres) that needs to be bought.
3. If the material for the blinds costs R 60 per metre, calculate the total cost of fabric for the blinds.
4. The school needs to tile the floor of the classroom. Calculate the total area that must be tiled.

5. If the tiles come in boxes of 4 m^2, how many boxes must the school buy? Explain your answer.

6. If the tiles cost R 150 per box, calculate how much the tiles will cost.

SOLUTION

1.

2.

	Real life measurement	**Calculation**	**Measurement on the plan**
Length of the walls	5 metres	5 metres = 500 cm 500 cm ÷ 50 = 10 cm	10 cm
Width of the door	810 mm	810 mm ÷ 50 = 16,2 mm	16,2 mm = 1,62 cm
Width of the window	1000 mm	1000 mm ÷ 50 = 20 mm	20 mm = 2 cm

3. There are 5 windows in total. Each window is 1000 mm wide.

   1000 mm × 5 = 5000 mm

   There are 1000 mm in a metre

   5000 ÷ 1000 = 5 m

4. R 60 per metre × 5 m = R 300

5. Area $=$ length$\times$breadth

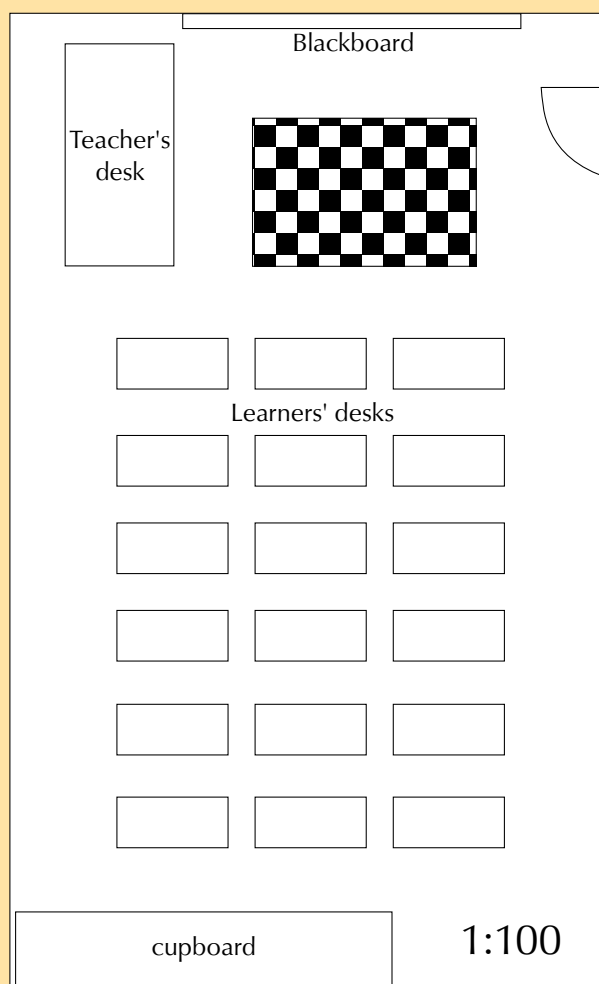
   $= 5 \text{ m} \times 5 \text{ m}$

   $= 25 \text{ m}^2$

6. $25 \text{ m}^2 \div 4 \text{ m}^2 = 6{,}25$ boxes

   You cannot purchase 6,25 boxes of tiles. You will have to buy 7 boxes.

7. $7 \times \text{R } 150 = \text{R } 1050$

Activity 10 – 4: Working with scaled floor plans

The diagram shows a classroom that has been drawn with a scale of 1 : 100.

1. Complete the following table:

	Measurement on the plan	**Calculation**	**Measurement in real life**
Length of the classroom			
Width of the classroom			
Length of the checkered rug			
Width of the checkered rug			

2. The teacher wants to replace the checkered rug. Calculate how big the new rug must be in m^2.
3. If the rug cost R 800 in total, determine the cost per m^2.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24PF 2. 24PG 3. 24PH

 www.everythingmaths.co.za **m.everythingmaths.co.za**

10.4 Packaging and models EMG67

When items are packed into a limited space like a box, cupboard or suitcase, how they are packed often determines how many items can fit into the space. A good example of this is trying to pack everything you need for your school day (like your books, sports equipment and food) into your school bag or backpack.

Your books must not be damaged in the process and you have to be able to carry everything yourself.

These same limits apply to posting a package to a friend or family member. An additional aspect to consider is the cost of the postage which is regularly determined by weight. Sending an extra container costs extra money as well. If what you are posting is fragile extra protective material must be packed between the items to make sure they reach the destination whole.

Worked example 7: Understanding packaging arrangements

QUESTION

Vuyo and Sipho's father own a biscuit business called Biscuits for Africa. It is the June/July school holidays and, to make more pocket money, their father has employed Vuyo and Sipho for one week to help package the biscuits into boxes so they can be transported to stores.

1. Vuyo has to pack small boxes of ginger biscuits into the large shipping boxes for transporting. There are 600 small boxes, and Vuyo's father tells him he can pack 15 boxes of biscuits into one large shipping box. How many large boxes will Vuyo need?
2. Sipho has to pack tin cans of chocolate biscuits into the same sized large shipping boxes that Vuyo is given. He is told he can fit 20 cans into one larger box. If there are 500 cans, how many large boxes will Sipho need?
3. If each large shipping box costs R 5,50. Which will be cheaper to pack - the ginger biscuits in small boxes, or the chocolate biscuits in tins?
4. Vuyo's and Sipho's father tells them that each large box can hold a maximum weight of 3,5 kg.
    a) If each small box of ginger biscuits weighs 200 g, how many small boxes can Vuyo pack into a bigger box without exceeding the weight limit?
    b) If each can of chocolate biscuits weighs 300 g, how many cans can Sipho pack into a bigger box without exceeding the weight limit?

The boys' father orders new large shipping boxes that are 45 cm long and 16 cm wide.

5. a) If the surface area of the bottom of one small box of ginger biscuits is 25 cm^2 (they are square: 5 cm$\times$5 cm), how many small boxes can Vuyo fit (only one layer deep) into the new large boxes? Draw a scaled diagram (1 : 100) to demonstrate this packaging arrangement.
    b) If the diameter of one round can is 5 cm, how many cans can Sipho fit (only one layer deep) into the new large boxes? Draw a scaled diagram (1 : 100) to demonstrate this packaging arrangement.

c) Vuyo wants to practice his Maths Literacy skills and rather calculate the area of the bottom of the large box and the small boxes, and divide the larger area by the small one to see how many boxes he can pack.
He does the following calculations:
Area of bottom of one small box $= 25\text{ cm}^2$.
$720\text{ cm}^2 \div 25\text{ cm}^2 = 28{,}8 = 28$ boxes.
This is different to Vuyo's initial calculation from Question 5 a).
Why do you think Vuyo got a different answer when he calculated the area alone?

SOLUTION

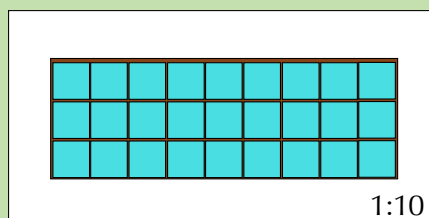
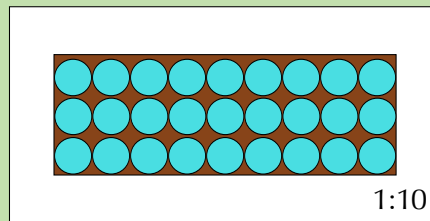
1. 600 small boxes $\div$ 15 per box $=$ 40 large boxes.

2. 500 cans $\div$ 20 per box $=$ 25 large boxes.

3. Ginger biscuits require 15 large boxes. $15 \times$ R 5,50 $=$ R 82,50
Chocolate biscuits require 20 large boxes. $20 \times$ R 5,50 $=$ R 110,00.
Therefore the ginger biscuits will be cheaper to pack, because they require fewer large boxes.

4. a) 3,5 kg $=$ 3500 g. 3500 g $\div$ 200 g $=$ 17,5. But Vuyo can't pack half a box of biscuits, therefore we round down to the nearest whole number: Vuyo can pack 17 small boxes of ginger biscuits into one large box.

   b) 3,5 kg $=$ 3500 g. 3500 g $\div$ 300 g $=$ 11,67. But Sipho can't pack 0,67 cans, therefore we round down to the nearest whole number: Sipho can pack 11 cans of chocolate biscuits into one large box.

5. a) Length of large box $=$ 45 cm.
45 cm $\div$ 5 cm $=$ 9 boxes.
Width of large box $=$ 16 cm.
16 cm $\div$ 5 cm $=$ 3,2 boxes. Vuyo can't pack 0,2 of a box, so we round this down to the nearest whole number, 3 boxes.
So Vuyo can fit 9 rows of 3 boxes each. $9 \times 3 = 27$ boxes.

   b) Length of large box $=$ 45 cm.
45 cm $\div$ 5 cm diameter $=$ 9 cans.
Width of large box $=$ 16 cm.
16 cm $\div$ 5 cm diameter $=$ 3,2 cans. Sipho can't pack 0,2 of a can, so we round this down to the nearest whole number: 3 cans.
So Sipho can fit 9 rows of 3 cans each. $9 \times 3 = 27$ cans.
Sipho can fit 27 cans of chocolate biscuits into the new large shipping boxes.

c) Calculating the area of the bottom of the large and small boxes does not take into account the shape of the boxes. We can see from the scale diagram in Question 5 a) that it is only possible to fit 27 small boxes into the larger box. 3 boxes in a row (3×5 cm $=$ 15 cm) do not fit exactly into the large box (16 cm wide) - there is a small space left which we cannot fill with boxes due to their shape. When dealing with packaging, it is very important to take shapes into account - we cannot just do area calculations without testing our packaging arrangement in reality!

Activity 10 – 5: Investigating packaging arrangements

For this activity you will need collect a number cans and at least three boxes of different sizes.

1. Measure the area of the bottom of the boxes, and the diameter of the cans. Using the length and width calculation method from the previous worked example, estimate how many cans you should be able to fit into each box.
2. Through trial and error find the best way to fit as many cans as possible into each box without damaging either the cans or the box.
3. Draw a top view of your final packing arrangement.
4. Compare your layout with the rest of your class.
5. Would it have been easier to pack boxes than cans? Motivate your answer.
6. How do you know that the cans are cylindrical rather than box-shaped? (Hint: Look at the shapes of the bases.)

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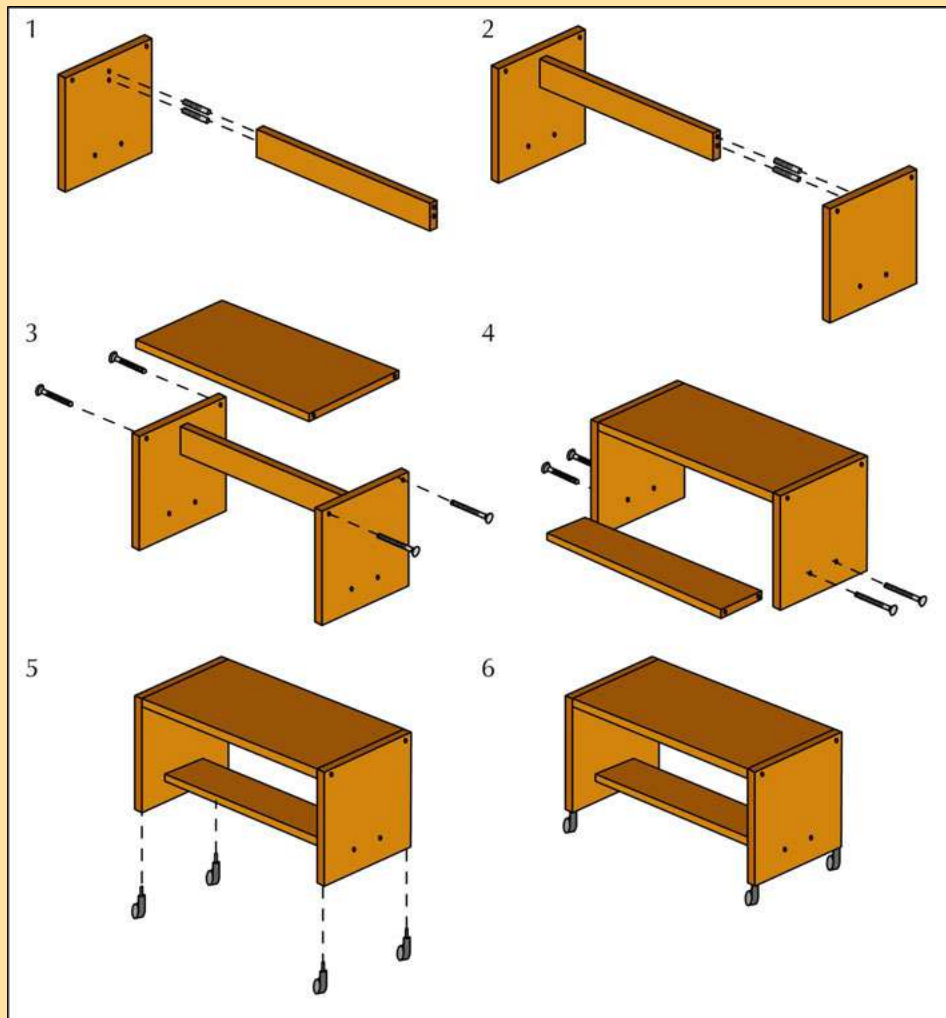
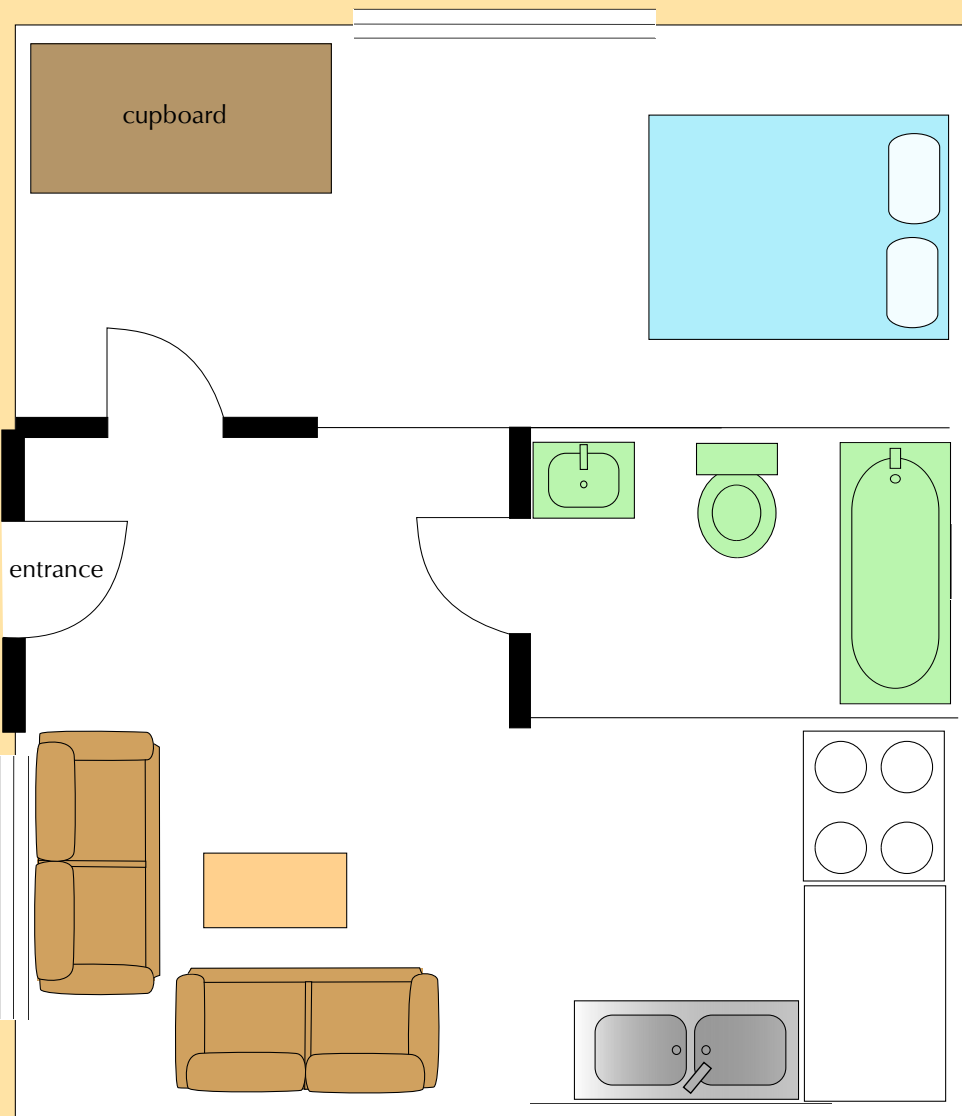
1. 24PJ 2. 24PK 3. 24PM 4. 24PN 5. 24PP 6. 24PQ

10.5 End of chapter activity EMG68

Activity 10 – 6: End of chapter activity

1. Robert buys a new TV cabinet that comes with the following pictoral assembly instructions:

   a) How many pieces of wood should Robert expect to find in the box that the cabinet came in?
   b) How many wheels should be in the box?
   c) If the cabinet did not come with screws, how may screws will Robert need to put the cabinet together?
   d) The assembly diagram does not indicate what tools Robert may need. List two tools you think he may need to assemble the cabinet.
   e) For each step (1 - 6) give a written description explaining what to do.
   f) Could the cabinet be assembled if Robert completes the steps in a different order? Explain your answer.

2. You are given the plan below for William's flat.

a) Identify five symbols used on this plan.

b) If the diagram above has been drawn on a scale of 1 : 50, complete the following table showing all calculations:

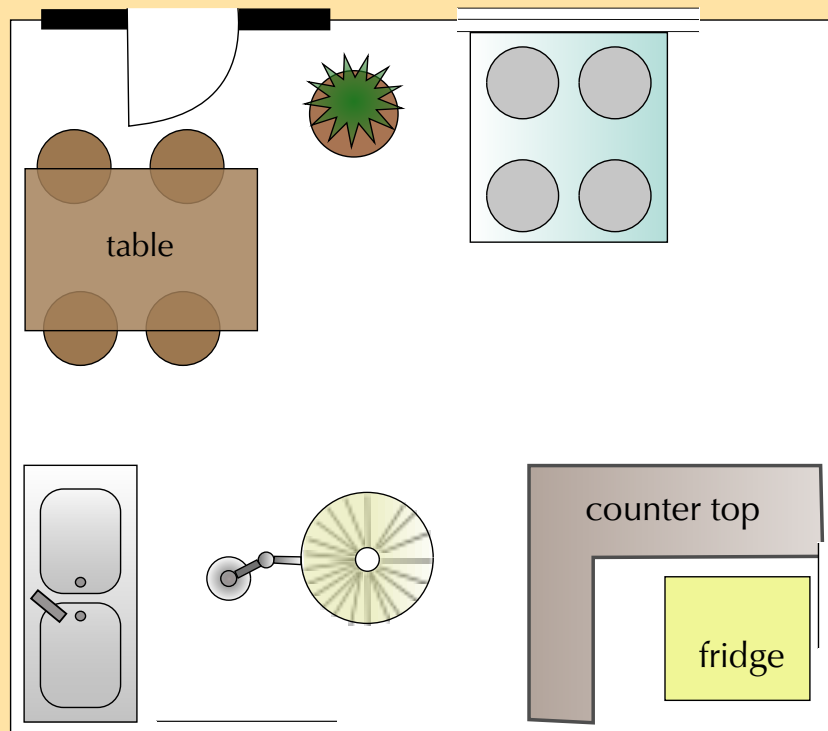
	Measurement on plan	**Calculation**	**Measurement in real life**
Bath (width)			
Bath (length)			
Main bedroom window (length)			
Kitchen sink (width)			
Bedroom (length)			
Bedroom (width)			

c) William wants to put tiles on the floor in the bedroom. Calculate how many m^2 of tiles he will need.

d) Calculate the cost of the tiles if one box contains 3 m^2 worth of tiles and costs R 120.

e) William's landlord is charging him R 90 per m^2 for the flat. How much is his rent in total?

f) For a birthday present William is given a new couch. The couch is 1,2 m wide and 2,5 m long. Will he be able to fit it through the front door of the flat?

3. The following plan is your friend's current layout for their kitchen.

a) Identify five problems with this layout in terms of the placement of the items. Motivate your answer.

b) Redraw the plan with an improved layout. All the elements present in the original diagram must be included in the improved plan.

4. You want to post a package to your friend who lives in Botswana. The contents are a brand of chocolate that your friend is struggling to find in the shops where they live. The following diagram shows what the chocolate looks like.

You have to fit as many of the chocolates as possible into a rectangular cardboard box which is twice as long as it is wide.

a) Suggest at least four different ways that these chocolates can be packed. Make a sketch to illustrate each method.

b) The chocolates weigh 100 g each. If the maximum capacity of the cardboard box is 2,5 kg, how many of the chocolates can you pack?

c) If each chocolate costs R 11,99, and you buy enough chocolates to fill the box to it's maximum weight, how much will you spend on chocolates?

d) If the cardboard box cost you R 10,00, and shipping to Botswana costs R 40 per kg, how much will the parcel cost you in total, including the cost of the chocolates? Assume that the box weighs 2,5 kg.

e) What will be easier to pack: cylinders or triangular prisms? Give a reason for your answer.

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1. 24PR 2. 24PS 3. 24PT 4. 24PV

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CHAPTER

Banking, interest and taxation

11.1 Introduction and key concepts EMG69

Banking is a very important service in our daily lives. These days money is managed mostly through banking (even electronic banking) and we need to develop appropriate skills to manage our finances.

In this chapter, you will apply basic mathematical skills to understand:

- the concepts of banking.
- types of bank accounts.
- Interest rates and interest values.
- Value Added Tax.

11.2 Banking accounts and documents EMG6B

Bank accounts EMG6C

DEFINITION: *Bank account*

A financial account that can be opened with a financial institution, e.g. absa, fnb, nedbank, etc.

When you open an account for the first time, you need to be familiar with the different types of accounts that are available. Banks usually offer a package of a few different accounts and services.

- Savings account: A bank account that earns interest. A savings account does not have an overdraft facility. You can use a savings account for short-term savings. You earn interest on the amount in the account, but not as much as you would earn with a fixed deposit account.
- Cheque or current account: A bank account that is used to deposit and withdraw money by visiting the bank branch, using an ATM or Internet banking or by writing a cheque. These are usually available to people who earn a regular income. They also have an overdraft facility, which allows you to use more money that you have in your account. Interest is charged on the overdraft.
- Fixed deposit account: A fixed deposit account is aimed at those who have a lump sum they want to invest over a set period of time. The money is deposited into the account and left there until the agreed upon date, when it is released back to the account holder with added interest. You would consider a fixed deposit if you want to save money for a medium to long term.

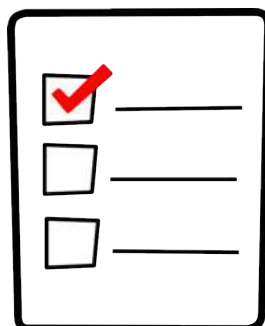
- Credit account (with credit card): An account either with a store or bank, that allows the account holder to purchase items now and pay for them later. Often the account holder is able to choose between the straight payment plan, where they will pay back the money in one lump sum, or the budget plan where the debt payments are divided up over a set number of payments. The two different payments have two different interest rates.

- Debit account (with debit card): Debit cards can be used to pay for purchases. When the card is swiped, instructions are sent to the account holder's bank to deduct the money from their account. Often this is their main account and is easier to manage than first paying for something with a credit card and then at a later date, transferring money into the credit card account. Usually a debit account does not offer as much credit as a credit account (if any at all).

The type of account you should open depends on your needs. For example, you might not have a fixed income, but want to save money to buy a Playstation, so a savings account would be the most appropriate for your needs as a learner.

Someone who is employed full-time will need a cheque account, so that their salary can be deposited there and they can apply for other benefits attached to this type of account.

Banking documents EMG6D

According to FICA (the Financial Intelligence Centre Act), people need to supply certain information and documents when they open a bank account.

- You must bring your identity document or passport.
- You must have proof of residence, which is a document such as a recent electricity or water bill that has your name and residential address on it.
- You must show proof of income, or information about your source of income, where the funds you expect to use in your transactions come from and the type of activities that can be expected on the account.

Bank statements EMG6F

A bank statement is usually sent to the account holder monthly. Bank statements show the following for each transaction:

- the date of the transaction
- a description of the transaction, showing the type of transaction
- the amount of the transaction, indicating whether it is a debit or a credit (often in different columns)
- a column for the balance after each transaction.

So a bank statement gives you a running total of the amount of money in an account for the month.

DEFINITION: *Account holder*

The person whose name the account is in.

DEFINITION: *Opening and closing balance*

The amount of money in the account at the beginning and the end of the period.

DEFINITION: *Transaction*

Any event where money moves into or out of an account.

DEFINITION: *Debit transaction*

Amount of money paid out of an account.

DEFINITION: *Credit transaction*

Amount of money deposited into an account.

Worked example 1: Understanding a statement

QUESTION

Xola receives the following statement from her bank, detailing her transactions from 25/01/2013 to 25/02/2013. Study the statement and answer the questions that follow:

Date	Description	Amount	Amount	Balance
25/01/2013	Salary	8000,00		8050,50
27/01/2013	Car insurance		−100,00	7950,50
01/02/2013	Electronic transfer Mr Serei (RENT)		−3000,00	4950,50
01/02/2013	Debit order Healthsaver medical aid		−500,00	4450,50
02/02/2013	Debit order Mobi contract		−250,00	4200,50
03/02/2013	Debit order Supa Fashion Store		−300,00	3900,50
05/02/2013	Purchase at Shop 'n Save		−2000,00	1900,50
14/02/2013	PAYMENT Mrs S Khumalo	500,00		2400,50
20/02/2013	Automechanix		−1000,00	1400,50
			Total remaining:	1400,50

1. How can you tell the difference between the debits and the credits in this statement?
2. List Xola's debits and credits for the month.
3. In the first line of this statement, Xola receives a salary of R 8000. Look at the balance to work out what she had in the account before the payment was made.
4. Xola receives some birthday money as well as her salary this month. Identify this transaction.
5. How much money would she have been left with, if she hadn't received money for her birthday?

6. Xola wants to save 15% of her remaining money this month. How much can she save?

SOLUTION

1. The credits are positive values and are in the left-hand column, while the debits are negative and are in the right-hand column.
2. Credits: Salary, deposit from Mrs S Khumalo.

   Debits: Car insurance, rent, medical aid, cellphone contract, clothing store account, groceries, car repair.
3. R 8050,50 = R 8000 = R 50,50, so she had R 50,50 in her account at the start.
4. 14/02/2103 PAYMENT Mrs S Khumalo R 500.
5. R 1400,50 - R 900 = R 500,50
6. 15% of R 1450,50 $= 1450,50 \times 0,15 =$ R 217,575, which is rounded off to R 217,58.

Activity 11 – 1: Understanding a bank statement

Here is an incomplete bank statement for Koketso's savings account at the end of March:

Date	Transaction	Payment	Deposit	Balance
27/02/2013	OPENING BAL			2304,85
1/03/2013	INTEREST ON CREDIT BALANCE		13,95	
1/03/2013	CHEQUE (SALARY)		2100,00	
1/03/2013	ATM CASH	400,00		
5/03/2013	ATM CASH	800,00		
10/03/2013	ATM DEPOSIT		600,00	
22/3/2013	SPENDLESS DEBIT CARD PURCHASE	235,95		

1. How are the debits and credits indicated on this statement?
2. Copy Koketso's statement and complete the balance column as a running total.
3. What is Koketso's balance at the end of March?

4. Koketso aims to keep a minimum balance of R 2500 in his account to earn interest. Is he succeeding?

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1. 24PW 2. 24PX 3. 24PY 4. 24PZ

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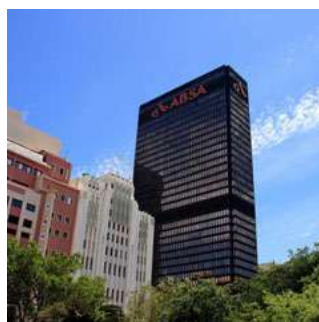
Banking fees EMG6G

Banks charge fees for the services they provide. Most cheque accounts, for example, have a monthly fee that needs to be paid to keep the account open. The bank will automatically deduct this fee out from the account every month. As well as this monthly fee, some banks charge a fee every time you withdraw or deposit money and for other services. These bank charges are called transaction fees. The transaction fees vary depending on which bank you use and which type of account you have.

You can reduce your transaction fees by choosing the most appropriate bank account for your own needs and also by adjusting your banking habits. For example, a bank account may offer a certain number of free withdrawals, deposits and balance enquiries per month, so if you keep within those, you can keep the fees low.

Worked example 2: Calculating bank fees

QUESTION

Arthur's bank, Egoli Bank list the following banking fees:

TRANSACTION	FEE
MONTHLY FEES	
Monthly maintenance fee	R5,00
Self-service banking subscription fee	R15,00
DEPOSITS	
Cash (over the counter/at Egoli Bank ATM)	R5,00
Cheque (over the counter/at Egoli Bank ATM)	Free
CASH WITHDRAWALS	
Over the counter	R10,00
Egoli Bank ATM	R5,00
Another bank's ATM	R7,00
Tillpoint - cash only	R1,00
Tillpoint - cash with purchase	R2,00
ACCOUNT PAYMENT AND PURCHASES	
Electronic transfers between accounts	Free
Electronic account payment	Free
Stop order	R5,00
Debit order - internal	R2,50
Debit order - external	R5,00
BALANCE ENQUIRIES	
Over the counter	First free per month, then R10,00
Egoli Bank ATM	First free per month, then R1,00
Another bank's ATM	R2,00
Self-service banking	Free

Arthur subscribes to self-service banking and pays a monthly maintenance fee. In the space of a month Arthur performs the following transactions:

- He deposits R 335,00 in cash at an Egoli Bank ATM.
- He withdraws R 500 cash at another bank's ATM.
- He withdraws R 100 cash over the counter in an Egoli Bank branch..
- He enquires twice about his balance, over the counter in an Egoli Bank branch.
- He draws cash, whilst buying groceries at a till point at his local supermarket.
- He makes 3 electronic account payments to pay his rent, electricity and phone bill.

1. Calculate the total bank charges for these transactions.
2. Arthur has a balance of R 650 in his bank account at the end of the month.

a) Calculate the ratio of the total bank fees to the month end balance.

b) Express this ratio as a percentage. (round your answer to 1 decimal place)

3. Suggest three ways in which Arthur could reduce his banking fees.

SOLUTION

1. R 5,00 (Monthly maintenance fee) + R 15,00 (self-service banking) + R 5,00 (cash deposit at Egoli bank) + R 7,00 (cash withdrawal at other bank) + R 10,00 (cash withdrawal over the counter) + R 0,00 (first balance enquiry) + R 10,00 (second balance enquiry) + R 2,00 (till point cash withdrawal) + (3 × R 0,00) (free electronic account payments) = R 54,00

2. a) Banking fees : closing balance = R 54 : R 650

   b) $\frac{R\ 54}{R\ 650} \times 100 = 8{,}3\%$

3. Arthur could withdraw cash at Egoli Bank ATM's only, not at other banks' ATMs or over the counter at a bank branch. He could ask for a balance enquiry from an Egoli ATM, or via self-service banking, instead of over the counter. He could withdraw cash only at a till point, without purchasing anything.

Worked example 3: Calculating bank fees

QUESTION

Lulama wants to withdraw R 650 from her savings account, at the ATM. The transaction fee for withdrawals is R 2,25 for the first R 100 plus R 1,20 for every additional R 100 (or part thereof). Calculate the bank fee.

SOLUTION

			R 650 (divided into full R 100 amounts or part thereof)			
↓	↓	↓	↓	↓	↓	↓
R 100	R 100	R 100	R 100	R 100	R 100	R 50
			(tariff/fee per R 100 or part thereof)			
↓	↓	↓	↓	↓	↓	↓
R 2,25	R 1,20	R 1,20	R 1,20	R 1,20	R 1,20	R 1,20

Therefore: R 2,25 for the first R 100 plus R 1,20 for every additional R 100 (or part thereof).

Bank fee $=$ R 2,25 $+$ (R 1,20 $\times$ 6) $=$ R 9,45

Activity 11 – 2: Calculating banking fees

1. Mia has recently open a Global account at Capital Bank. She is concerned about her monthly bank charges. Use the provided brochure and the list of her account activities for the month of April to answer the questions bthat follow.

   The list of Mia's transactions for April is as follows:

Date	Activities	Amounts
1 Apr 2013	Balance of previous month carried forward	R 210,25
1 Apr 2013	Old Mutual Policy x74534: Debit order returned: insufficient funds*	R 254,39
1 Apr 2013	Balance enquiry (mobile)	R 0,00
2 Apr 2013	Davidsons Textiles: Salary deposit*	R 4500,00
2 Apr 2013	Shoprite: Purchases: Debit card*	R 847,21
2 Apr 2013	Shoprite: Cash withdrawal*.	R 250,00
7 Apr 2013	Old Mutual Policy x74534: Branch Payment	R 254,39
15 Apr 2013	Edgars: Purchases: Debit card*	R 149,59
20 Apr 2013	Capital Bank ATM Withdrawal*	R 200,00
23 Apr 2013	Shoprite: municipal account payment*	R 639,00
28 Apr 2013	FNB ATM Withdrawal*	R 500,00
29 Apr 2013	Balance statement at the branch	R 3,00
30 Apr 2013	Monthly Administration Fee	R 4,50

   * denotes SMS notification for April

TRANSACTION	FEE
Monthly fees	
Monthly administration fee	4.50
Mobile banking subscription	FREE
Internet banking subscription	FREE
Cash withdrawals	
Supermarket tillpoints	1.00
Capital bank ATM	4.00
Other ATM	7.00
Balance enquiries	
Mobile banking	FREE
Cashier	FREE
Capital Bank ATM	FREE
Other ATM	4.00
Transfers/Payments/Purchases	
Debit card purchase	FREE
Debit order/recurring payment at branch	3.00
Debit order/recurring payment with internet banking	1.50
Payment to other Capital Bank account at branch	3.00
Payment to other Capital Bank account with internet banking	1.50
Other	
SMS notification	0.40
Statement in branch	3.00
Create, change or cancel recurring payment at branch	4.00
Returned debit order/ recurring payment (stop order)	4.00
Returned early debit order	FREE
Insufficient funds (other ATM)	4.00

a) How many withdrawals did Mia make during this month?

b) Calculate the amount of money that was spent on monthly shop purchases

c) Use the relevant resources and calculate the amount of bank fees that Mia should pay for April.

d) Suggest how Mia can further reduce her banking charges.

2. A bank uses the following formula to calculate the bank charges (transaction fee) on money deposited at a branch (inside the bank): **Transaction fee = R 2,50 + 0,95% of the amount deposited**.

   a) Use the above formula to calculate the bank fees on the following deposits:

      i. R 450

ii. R 117,35

iii. R 6 500 000

b) Use this formula to see if the transaction fee of R 5,59 was correctly calculated from a deposit of R 325.

3. Calculate the bank fee on the following deposits at the ATM if the transaction fee is R 0,90 for every R 100 (or part thereof) deposited:

   a) R 450

   b) R 637,14

   c) R 3500,05

4. Tumi withdrew R 350 from her savings account, at the ATM. The withdrawal transaction fee is R 2,35 for the first R 100, plus R 1,15 for every additional R 100 (or part thereof). Calculate the bank fee.

5. The transaction fee of a cash deposit at a branch is R 2,45 + 0,85% of the deposited amount. If Tumi deposits R 875,00 at the bank, calculate the bank charges.

6. Demi wants to withdraw R 750,00 from her savings account at an ATM. The withdrawal transaction fee is R 1,20 for the first R 100 plus R 0,75 for every additional R 100 (or part thereof). Calculate the bank fee.

7. A bank charges the following fees for cash deposits:

   Bank teller: 2,5% of deposit value

   ATM deposit: R 1 basic + R 1,20 per R 100 or part of R 100

   a) Is it more expensive to go into the bank or to do the transaction at an ATM? Why do you think this is?

   b) Using the formulae given above, fill in the table below to show the transaction fees for the given amounts of money:

Deposit amount (R)	500	1000	1500	2000	2500	3000	3500
Fee at teller							
Fee at ATM							

   c) Plot two graphs of the transaction fees for the different amounts of money given in the table.

   d) Read off the graph: how much money can you save by using an ATM if you need to deposit R 1250?

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1. 24Q2 2. 24Q3 3. 24Q4 4. 24Q5 5. 24Q6 6. 24Q7
7. 24Q8

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11.3 Interest EMG6H

People need to pay interest when they borrow money, either from a bank, or if they purchase an item from a shop and pay it off in monthly installments using a hire purchase option. Buying an item on hire purchase is also borrowing money. The interest amount is calculated as a percentage of the amount owing.

If you save money in a bank account, you also earn interest on the balance in your account.

DEFINITION: *Interest rate*

A **percentage** charged for the borrowing, or loan, of a sum of money over a given period of time.

DEFINITION: *Interest*

The amount of money that you are charged (by the lender of money, e.g. the bank) for borrowing an amount of money, over a period of time.

Interest rates EMG6J

Interest rates can vary considerably. The interest rate that a person is charged depends on how much money they leave invested in the bank, and on other factors, including:

- The South African Reserve Bank's lending rate (repo-rate) to financial institutions. This can change from month to month, and banks usually link their rates to the repo-rate.
- Different banks may offer different deals, depending on various conditions. For example, you may get a lower interest rate on a loan if you open an account with the same bank.
- Credit ratings: If you are opening your first bank account you do not have a "banking history". This means you will not have a credit rating history either and will probably be charged a higher interest rate if you wanted to take out a loan.
- How long you have been employed in your present job or whether you own assets such as a home.
- If you save more money for a longer period, the bank is likely to offer a higher interest rate on your savings.

Calculating interest amounts and interest rates EMG6K

If we know what the interest rate is, we can calculate the interest value quite simply:

10% interest on R 3500 = R 3500 × 10% = R 350. So the interest amount is R 350 and the total amount is R 3500 + R 350 = R 3850.

If you are given the final amount, then you follow these steps to find the interest rate:

- Find the difference between the final amount and the original amount: this gives you the amount of interest.
- Work out what percentage the amount of interest is of the original value.

Let's look at a worked example to see how to do this.

Worked example 4: Understanding interest

QUESTION

Look at the advert on the following page. You can buy a 3-piece wall unit cash for R 6499,99. Alternatively, you could choose to buy it on hire purchase and pay for it in installments over 3 years. If you choose to pay it off in installments, you will pay interest every month on the wall unit.

1. Calculate what the wall unit will cost if you pay a cash deposit of R 650, and 36 monthly installments of R 449 each. (Total = cash deposit + 36 monthly installments).
2. Calculate how much interest you will pay in total (in Rands) if you pay off the wall unit in installments. (Hint: interest amount = total payments - cash price).
3. Calculate the interest rate. (Interest rate = (Interest ÷ total paid) × 100).
4. Do you think it is better to save up and buy the wall unit at the cash price, or pay it off over 3 years? Explain your answer.

SOLUTION

1. Total = cash deposit + 36 monthly installments = R 650 + (R 449 × 36 months) = R 650 + R 16 164 = R 16 814
2. Interest = Installment total - cash price = R 16 814 - R 6499,99 = R 10 314,01.
3. Interest rate $= \frac{\text{interest amount}}{\text{total amount}} \times 100$

   $= \frac{\text{R}10\ 314{,}01}{\text{R}\ 16\ 814{,}00} \times 100$

   $= 0{,}613 \times 100 = 61{,}4\%$.
4. It is much cheaper to save up and buy the wall unit at the cash price. Over three years, the total amount you would pay in installments is more than twice as expensive as the cash price!

Activity 11 – 3: Understanding interest

You found the following advertisement in a local newspaper. Answer the following questions.

1. Does the advertisement indicate the percentage of interest that will be charged if the TV is not paid for in cash?
2. What will the balance be once the deposit has been paid?
3. Will the interest be charged on the full purchase price or on the balance?
4. How much will the installments be per month?
5. How much will you have to pay for the TV in total?
   Use the formula:
   Total to be paid = Deposit + (Installment amount × number of installments)
6. How much interest (in Rands) will you have paid once you have completed paying off the TV ? Use the formula:

   $$\frac{\text{Total interest payable}}{\text{Value}} = (\text{Installment amount} \times \text{number of installments})$$

   $-$ Balance

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24Q9 2. 24QB 3. 24QC 4. 24QD 5. 24QF 6. 24QG

Worked example 5: Understanding interest

QUESTION

Grant borrows R 15 000 from his friend, Molefe, to finish an order for his customers. Molefe offers the following:

- The loan plus 12% simple interest per annum
- Interest Value = Interest rate as a percentage of the borrowed amount.
- Total Repayment = borrowed amount + interest value.

1. Calculate the amount of interest for the interest rate Molefe offered.
2. How much in total will Grant have to pay?

SOLUTION

1. Interest amount $= \frac{12}{100} \times$ R 15 000 = R 1800
2. Total repayment = Borrowed Amount + Interest Value.
   = R 15 000 + R 1800 = R 16 800.

11.4 Value Added Tax EMG6M

As we learned in Chapter 4, VAT is the acronym for Value Added Tax. VAT is a form of tax that everybody has to pay when buying goods and services. It is charged as 14% of the price of the goods. The 14% is paid to the provider of the goods and services, and they in turn pay it to the government.

VAT is charged at every stage of producing and selling goods. If the person who pays tax is going to use the goods that they buy to make an income, then they can deduct the VAT that they have paid. So the final consumer pays the VAT, while the people along the chain of producing goods and services do not.

Certain items, such as basic foods, like milk, bread, fresh fruit and vegetables, maize meal and tinned pilchards are exempt from VAT, which means that they are not taxed. Educational fees, and bus, train and taxi fares are also exempt from VAT.

DEFINITION: *Vat inclusive*

This is a price that includes VAT.

DEFINITION: *Vat exclusive*

This is a price that excludes VAT.

DEFINITION: *Vat exempt*

An item that is VAT exempt does not have VAT added to the price of the item.

Worked example 6: Calculating the VAT on purchases

QUESTION

Zinhle visited the Sunshine Supermarket in Wellville. After paying for her shopping, she checks her till slip and thinks that the VAT (R 22,05) on the till slip is incorrect. She calculates 14% of R 186,55 to be R 26,12.

```
   Sunshine Supermarket

  61 11th Street, Wellville
    Tel no. 061 711 2813

Tax invoice VAT No. 442 00010895

Ginger biscuits          R13.99
Cott/Cheese              R15.99
Cott/Cheese              R15.99
Tomatoes, pkt            R 6.99 *
Choc One 60G             R 5.49
Plastic bag 24L          R 0.39
Veg  pie                 R 9.99
Yoghurt s/berry 175ml    R 5.79
Yoghurt plain 175 ml     R 5.49
L/FAT yoghurt 175ml      R 5.49
Cheddar chs /kg          R22.93
Teabag R/Bos             R19.99
Ice cream vanilla        R19.99
Lemon shampoo            R15.99

 Balance due             R186.55


 Rate   VAT             TOTAL
 14%   22.05            157.51
 *0%    0.00              6.99

PLEASE RETAIN AS PROOF OF PURCHASE.
```

Show that Zinhle is incorrect by answering the following questions:

1. Why are the tomatoes indicated with a *?
2. What is the total cost of the items that are VAT inclusive?
3. Is 14% of this total R 22,05 or R 26,12?
4. Show how the balance due (R 186,55) was calculated.
5. Explain why Zinhle is incorrect in believing the VAT is wrong.

SOLUTION

1. The tomatoes are a basic foodstuff and so they are exempt from VAT.
2. R 157,51.
3. R 22,05
4. Balance due = (total cost of VAT incl. items) + (14% VAT on those items) + (total cost of VAT exempt items).
5. Zinhle calculated the VAT as 14% of the **total** balance due, not as 14% of the VAT inclusive items only.

Zinhle was following the excellent practice of checking her till slip - sometimes they are incorrect! Let's see how this can be.

Worked example 7: Checking a till slip

QUESTION

Nompumelelo bought some groceries at Dicey Stores. Answer the following questions about the till slip below.

```
                DICEY STORES

          61 11th Street, Dodgeville
             Tel no. 061 333 9999

   Tax invoice VAT No. 4423338888109

   Milk tart                   R17.99
   Apple crumble               R29.99
   Carrier bag 24L             R 0.40
   Carrier bag 24L             R 0.40
   Marshmallow 60g             R 9.99
   Dairy custard               R17.99
   Hot dog rolls               R 6.65
   Lemon biscuits              R 7.99
   ENT. bacon/egg LF
   0,458 kg @ R49.99/kg        R22.90
   Sunflower oil 250ml         R14.99 *
   Popcorn 300g                R 7.99
   Chicken-mayo sandwich       R23.99
   Brown bread seed            R10.99 *
   Brown bread loaf            R 6.99 *
   Sauce Peri Peri             R13.99

   Balance due                R215.68

   EFT credit card            R215.68

   TAX-CODE     TAXABLE    TAX VALUE
   Zero VAT    R 32.97       R0.00   *
   VAT         R160.27      R23.73
   Total tax                R23.73

   CHANGE                    R0.00
```

1. Why are some items marked with a star (*)?
2. List the items that are VAT exempt and how much each cost.
3. On the receipt the amount of the VAT is R 23,73.
   a) What is the total cost of the VAT exempt items? Check that you agree with the total given.
   b) What is the total cost of the items that are subject to VAT (before VAT is added)?
   c) What should the VAT on this total be?

d) Has the VAT been calculated correctly?

SOLUTION

1. They are VAT exempt items.
2. Sunflower oil = R 14,99
   Brown bread seed = R 10,99
   Brown bread loaf = R 6,99
3. a) R 14,99 + R 10,99 + R 6,99 = R 32,97. This is correct.
   b) R 160,27
   c) 14% of R 160,27 is R 22,44
   d) No, they have miscalculated the VAT at R 23,73.

Activity 11 – 4: Calculating VAT and checking till slips

1. Bongi decides to use the following formula to calculate the cost of the items before VAT, the VAT and the VAT inclusive price.

   Total cost (R) = Amount before VAT (R) + 14% of the amount before VAT (R).

   Complete the table below by calculating the values of a) to g). a) is the total of the Amount (R) and e) is the total of VAT (R). Show all your calculations.

Amount	8,76	8,76	21,92	6,13	0,35	17,54	24,55	28,06	**a)**
VAT	1,23	1,23	3,07	0,86	0,05	**b)**	**c)**	**d)**	**e)**
Total	9,99	9,99	**f)**	**g)**	**h)**	19,98	27,99	31,99	**132,32**

2. Bongi's friends Nthabiseng and Thato calculated e) in this way:

   Nthabiseng: 14% of R 116,07 = $\frac{14}{100} \times$ R 116,07 = R 16,24
   Thato: R 132,32 - R 116,07 = R 16,25

   Why do they get different answers?

3. Copy the slip and correct the mistakes:

```
              DICEY STORES

      61 11th Street, Dodgeville
         Tel no. 061 333 9999

 Tax invoice VAT No. 4423338888109

 Milk 2L                    R17.99 *
 Apples 2,5kg               R20.99 *
 Carrier bag 24L            R 0.40
 Carrier bag 24L            R 0.40
 Sunflower oil 250ml        R14.99 *
 Salted chips               R 7.99
 Brown bread loaf           R 6.99 *
 Brown bread loaf           R 6.99 *
 Sauce Peri Peri            R13.99

 Balance due               R90.73

 EFT credit card           R90.73

  TAX-CODE     TAXABLE    TAX VALUE
  Zero VAT     R0           R0.00   *
  VAT         R79.59        R11.14
  Total tax                 R11.14

  CHANGE                     R0.00
```

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24QH 2. 24QJ 3. 24QK

11.5 End of chapter activity EMG6N

Activity 11 – 5: End of chapter activity

1. The TownBank current account charges R 3,30 plus R 1,20 per R 100 or part thereof for a cash withdrawal from a TownBank ATM. The first five withdrawals in a month are free. Determine the bank charges for a withdrawal of:

   a) R 400, the sixth withdrawal

b) R 850, the fourth withdrawal

c) R 3000, the tenth withdrawal

d) R 250, the seventh withdrawal

2. The Success Current Account charges R 3,75 plus R 0,75 per full R 100, to a maximum charge of R 25,00 for debit card purchases. Determine the charges for a purchase of:

   a) R 374,55

   b) R 990,87

   c) R 2900,95

3. You are given the following information about bank charges for a TownBank current account.

Withdrawals

Over the counter: R 23,00 plus R 1,10 per R 100 or part thereof

TownBank ATM: R 3,50 plus R 1,10 per R 100 or part thereof

Another bank's ATM: R 5,50 plus R 3,50 plus R 1,10 per R 100 or part thereof

Tillpoint - cash only: R 3,65

Tillpoint - cash with purchase: R 5,50

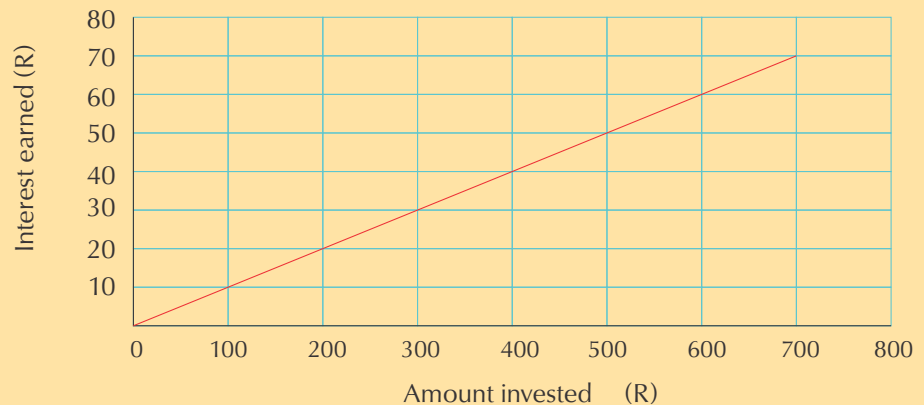
   a) Calculate the fee charged for a R 2500 withdrawal from a TownBank ATM.

   b) Calculate the fee charged for a R 750 withdrawal from another bank's ATM.

   c) Calculate the fee charged for a R 250 withdrawal from the teller at a branch.

   d) What percentage of the R 250 withdrawal in question (c) is charged in fees?

   e) Would it be cheaper to withdraw R 1500 at the bank, from a TownBank ATM or from a till point with a purchase?

4. Study the graph and answer the questions that follow:

a) Complete the table below: (Fill in all the missing spaces)

Amount invested (in Rands)	100	200	300	400	500	600	700
Interest Earned (in Rands)	10		30		50		70
(Interest $\div$ Amount) $\times$ 100 (Interest Rate)							

b) What kind of proportionality exists between the amount invested and the interest earned?

c) You decide to invest R 10 000. Calculate the amount of interest you can expect to earn.

5. Complete the table below by calculating the missing amounts.

Amount (R)	17,95			33,80	4,50		
VAT (R)	2,51	14,00	1,4				
Total (R)	20,46		11,40			221	404,00

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24QM 2. 24QN 3. 24QP 4. 24QQ 5. 24QR

CHAPTER

Data handling

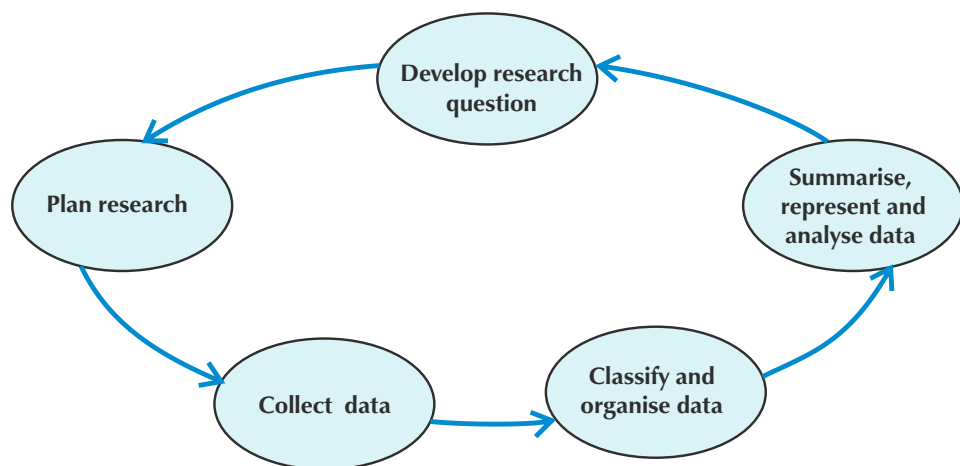
12.1 Introduction and key concepts EMG6P

In this chapter you will learn how to:

- develop a research question.
- collect, classify and organise data.
- summarise, represent and analyse data, in order to answer your research question.

12.2 The data handling cycle EMG6Q

The process of data handling is summarised in the diagram below.

In this chapter we will go through all the steps in detail, and learn how to manage them correctly so that we end up with good, usable data.

We represent the process of data handling as a cycle, because once we have analysed the results we may have new questions.

DEFINITION: *Research*

Studying a subject to uncover new facts.

The issue of bias and collecting valid data EMG6R

When we want to find information, we have to be very certain that we don't influence the process to get a certain kind of result. This doesn't only happen when people are

trying to get a certain kind of result. In can also happen without you planning it. If you expect to see a certain result, you are more likely to see it! So at all the stages of collecting data, we must plan carefully to make sure that the data we get is **valid**.

DEFINITION: *Valid*

In statistics, valid data means that the data represents the real world accurately.

12.3 Developing questions EMG6S

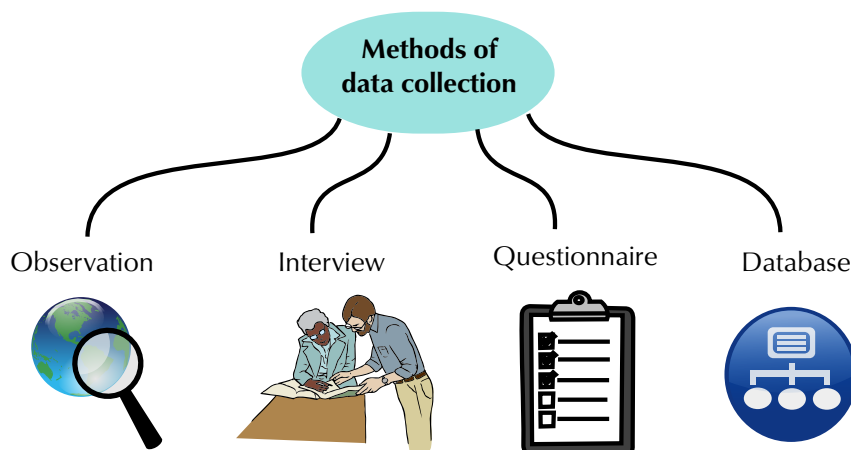
The aim of the research EMG6T

Before we start the research process, we need to make sure that we state the aim of the research clearly. Try to state this in a way that can be measured.

For example, "I want to find out what learners think about the school" is not a clear enough statement. "To find out learners' opinions about the condition of the school buildings and whether the facilities are adequate" is stated more clearly.

12.4 Collecting data EMG6V

Different ways of collecting data EMG6W

The aim of the research influences the way data will be collected. Four methods of collecting data are:

1. **Observation**: Data collection using observation does not entail personal contact. Counting the number of vehicles crossing an intersection every hour would be a good example of observational data gathering.

2. **Interview**: This takes place usually between two people where one is called the interviewer and the other is the interviewee or respondent. This method is usually chosen when it is convenient to talk to the respondents directly. For example if we wanted to determine whether people were happy with the way they were treated by sales staff.

3. **Questionnaire**: a questionnaire is a predetermined set of questions given to a number of respondents to complete. This instrument is good for getting information from many people. Questionnaires are also appropriate for getting information from people that are spread over a wide area and that are not easy to contact face-to-face. A questionnaire should have a short explanation of what your research is about. As with all data collection methods, questionnaires should always adhere to ethical and moral codes of conduct. An example of a questionnaire in use is the national population census for South Africa, which takes place every ten years (the last one was in 2011).

4. **Databases:** Sometimes we can use information that is already stored in a database, so that we don't actually have to find the data. Databases are simply organised lists of data - the list of learners at your school is a kind of database. Databases can be computerised, books or paper filing systems. A big advantage of these is that the data is already organised and is easy to access.

The method of collecting data must be suitable for the type of research we are doing. Let's look at examples to see why.

Worked example 1: Deciding on the best way to collect data

QUESTION

Which method would be appropriate for collecting data for each of the cases below? Give a reason for your choice.

1. How many learners at your school know about tuberculosis (TB) and what their perceptions are.
2. Whether bank clients feel that they are treated professionally or not by the bank staff.
3. The symptoms of hospital patients with cancer.

4. The average age of all learners in Grade 10.

SOLUTION

1. Anonymous questionnaires would be useful so that learners don't have to worry about answering incorrectly. Interviews by a skilled interviewer could be useful so that the interviewer could find out more about what the learners know and believe about TB.
2. A questionnaire that clients fill in while visiting a bank would be a convenient way to collect this information.
3. Observation (in the form of a medical examination) would be the best method.
4. This information could be most easily obtained from a database, e.g. from the school's register of learners, which should have all the learners' dates of birth.

Activity 12 – 1: Deciding on the best way to collect data

1. Which method would you use to collect data for each of the following?

    a) The number of pens each learner in your class has.

b) The number of hours each learner in your class slept last night.
c) The weight of all learners in your class.
d) Customers' opinions on the new design of a shop.

2. Develop two or three interview questions you can use to get information about:

   a) Learners' opinions about how their school uses technology in the classroom.
   b) Whether learners in your school have mobile phones.

   c) The brands of cell phones that learners have.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24QS 2. 24QT

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Deciding who to ask EMG6X

The group that we want to collect data from is called the **population.** In some cases, we can ask every person in the group we are interested in, to answer a questionnaire.

Of course, not everyone will answer. The higher the number of respondents you get, the more valid your data will be.

In other cases, we need to choose a **sample** of people from the population. The choice of sample can have an effect on the reliability of the data and could even lead to sample bias.

DEFINITION: *Sample*

A small selection of a larger population or collection.

Sample bias occurs when a certain section of the population from which the sample is drawn is not representative of that population. You, as the researcher, need to find a way to take a sample that is likely to represent the population well. For example, if you want to find out what learners at your school think about physical exercise and keeping fit, the soccer team would not be a good sample. They don't represent the rest of the learners, and might be biased, because they are more likely to be fit and enjoy exercising. You should rather find of a way of giving every learner an equal chance of being in your sample. One way would be to ask every tenth learner who arrives at the school gate in the morning.

One way to avoid sample bias is to select a **random** sample. A sample is random if every member of the population has the same chance of being selected - the interviewer doesn't choose particular people. Asking every tenth learner who arrives at the school gate would be an example of a random sample. Sometimes random samples can still result in sample bias however - so it is always important that your random sample is still representative!

Figure 12.1: An example of a population is all the learners at a school.

Figure 12.2: An example of a sample is a small (representative!) group of learners from the same school.

How to develop a good questionnaire EMG6Y

The questionnaire also has an important role in making sure that the information you collect is valid. You should aim to get a high number of respondents and accurate in-

formation. If not enough people fill in the questionnaire, then you don't know whether the information you get reflects the real situation.

The tips below help you to make sure that your questionnaire is clear and accurate, and also that people are likely to complete it.

1. Keep it short. Don't include information that you already know.
2. Write down all the relevant questions you can think of. Next, analyse the appropriateness of each question by asking these things:
    - Is this question necessary? If not, don't include it in the questionnaire.
    - Is it possible for the respondent to answer this question? Don't assume that the respondent can remember something that happened five years ago, or that he or she will have certain information.
    - Will the respondent answer the question honestly?
    - Can the question be answered quickly?

You can make some questions easier to answer. Using categories instead of precise answers may also make it easier for respondents to complete the questionnaire. For example, most people do not like telling people their age, weight or salary, but grouping those numbers into categories makes it easier to answer.

1. Decide how to ask the question. There are two different types of responses: open-ended and closed-ended.

    In an **open-ended** question, the answer is usually the opinion of the respondent and the respondent can answer in their own words. In this way you can gain insightful data and avoid receiving answers that are biased. A disadvantage to this type of question is that respondents might leave it out if it takes too long to answer.

    Closed-ended questions could give respondents some options for the respondent to choose from, which is convenient because they can simply tick the right box.
2. Check the wording for each question. Look at the questions you have written and ask, "Will people be able to understand this question?"
3. Decide on an order of questions that is easy to understand.

Activity 12 – 2: Developing a questionnaire

1. Collect information on the following topic: "the heights of learners in your class". Base your data collection tool on the example given below.

Choose one of the following three approaches:

a) Questionnaire: If there are a lot of learners to interview, this method would be too time consuming an option.

b) Observation: Appropriate for gathering a rough estimate.

c) Using a database: Height of each learner could be obtained from school or clinic records.

Questionnaire example

Hi there! We are conducting a survey to get information about the heights of learners in this school.
Please tick the correct box below.
Is your height:

Shorter than 140 cm?	
140 - 149 cm?	
150 - 159 cm?	
160 - 169 cm?	
170 cm or taller?	

Observation sheet for collecting measurement data

Range of heights (cm)	Number of learners
Shorter than 140 cm	
140 cm - 149 cm	
150 cm - 159 cm	
160 cm - 169 cm	
Taller than 170	

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24QV

12.5 Classifying and organising data EMG6Z

Classifying data EMG72

After data has been collected, the next stage in the data handling process is to classify it. There are two main ways data can be classified. These are:

1. **Categorical data**: This is data that cannot be measured numerically but can be described, like the gender of a person (male or female), or the colours of sweets in a jar.

2. **Numerical data**: This is data that can be measured by using numbers, like the height of person or the number of books in your bag.

   Numerical data can be further classified into **discrete data** and **continuous data**. Data is discrete if each value can only have one specific value that can be counted. Examples of discrete data would be a number of bicycles (1; 5; 8, not $\frac{1}{2}$ a bicycle!) or the number of puppies in a litter (again: 3 puppies; 6 puppies but not $\frac{1}{3}$ of a puppy!)

   Continuous data is data that can have any value - for example, a person's weight may be anything between 50 or 100 kg, including 67,4 kg or 78,3 kg. Weight is not only measured in single kilograms. The amount of rainfall is also continuous data - it can be any amount and is not limited to specific kinds of values (rain does not only fall in 100 ml quantities, for example!).

Organising data EMG73

Data can be organised by using:

- **Tallies** - Tallies are a way of counting how many of each group there are. The advantage of using tallies is that you can keep a running total.

Here is an example of a tally table showing numbers of differently coloured cars (Note that each counted item is represented by one line marking):

Car colours

Colour	Tally
Red	~~||||~~ ||
Green	|||
Blue	||||
Yellow	||

For each differently coloured car we see, we make a mark. When we get to 5 cars, we draw a line through the previous four marks and then start a new group of marks. This makes it easy to count up the tallies in groups of 5 markings.

- **Frequency tables -** A frequency table shows the list of categories or groups of things, together with the number of times the items occur. Here is an example of a frequency table, again, showing the number of differently coloured cars. The frequency is the same as the number of marks we made in the tally table above.

  Car colours

Colour	Frequency
Red	7
Green	3
Blue	4
Yellow	2

- **Class intervals -** when you have a lot of data to organise, e.g. heights of 15 year old learners in a school, it becomes easier to manage if these heights are grouped into specific bands. Here is an example of grouped data showing the heights of 32 Grade 10 learners.

Height range	Number of learners (Frequency)
$<$ 1,20 m	1
1,20 m - 1,29 m	0
1,30 m - 1,39 m	2
1,40 m - 1,49 m	4
1,50 m - 1,59 m	7
1,60 m - 1,69 m	11
1,79 m - 1,79 m	7
$>$ 1,80 m	0

NOTE:
When we are given intervals of continuous data, such as 1,50 m - 1,59 m, we include the lower boundary, but not the upper one. So the measurement of 1,60 m belongs in the interval 1,60 m - 1,69 m.

Worked example 2: Working with grouped data

QUESTION

This grouped frequency table shows the heights of some young plants (seedlings). Remember that we include the lower boundary but not the upper one in each interval.

Height of seedling (mm)	Frequency
10 - 14	3
15 - 19	6
20 - 24	7
25 - 29	5
30 - 34	4

1. How many plants were measured altogether?
2. How many plants are less than 20 mm high?
3. How many plants are more than 25 mm high?
4. Into which interval would you place a plant that is 29,8 mm high?
5. How many plants are at least 25 mm high?

SOLUTION

1. $3 + 6 + 7 + 5 + 4 = 25$ plants were measured altogether.
2. $3 + 6 = 9$ plants are less than 20 mm high.
3. $5 + 4 = 9$ plants are more than 25 mm high.
4. In the interval 25 - 29 mm.
5. There are nine plants that fall into the intervals of 25 mm and longer.

12.6 Summarising data EMG74

After data has been collected, classified and organised it is not always possible to mention every piece of data in a report. Instead we summarise data by describing the whole data set using just a few numbers. Summarising data also makes it easier to analyse the data later.

Measures of central tendency and measures of spread EMG75

Data can be summarised by using measures of central tendency or measures of spread.

Measure of central tendency is a single value that attempts to show what the central position is of a set of data. Measures of spread describe how the data is spread out or dispersed.

There are three types of measures of central tendency: mean, mode and median.

Mean

The mean is the most common measure of central tendency that is used. It is also known as the average. It is calculated by adding all the values together and dividing by the number of values in the data set. E.g. If you have numbers 2; 6; 8; 10; 12; 14; 18; the mean is calculated as:

$$\frac{\text{The sum of the observational values}}{\text{The number of observations}} = \frac{2+6+8+10+12+14+18}{7} = 10$$

Worked example 3: Finding the mean

QUESTION

1. Find the mean of the numbers 4; 6; 7; 3; 4; 8; 4; 2; 9.
2. The frequency table below shows the test marks achieved by 20 learners. The test was marked out of 10. Calculate the mean mark.

Mark	4	6	7	8	9	10
Frequency	2	4	3	6	3	2

SOLUTION

1. To find the mean we add all the values of the data and divide by how many data values there are. Therefore mean value of the numbers 4; 6; 7; 3; 4; 8; 4; 2; 9 is calculated as follows. We add $4 + 6 + 7 + 3 + 4 + 8 + 4 + 2 + 9$ and get the following number 47. now we must count how many values we added together. In this example we used 9 values. So the mean is $\frac{47}{9} = 5{,}2$.

2. Here we need to add the marks of 20 learners, but because some of the marks are repeated we can use multiplication as a short method for adding the same number several times. The total of the marks $= (4 \times 2) + (6 \times 4) + (7 \times 3) + (8 \times 6) + (9 \times 3) + (10 \times 2) = 148$
So the mean is $\frac{148}{20} = 7{,}4$

Activity 12 – 3: Calculating the mean

1. Find the mean of each of the following data sets:
   a) 5; 7; 19; 24; 10; 17; 21; 6; 22; 5; 9
   b) 4; 3; 1; 6; 1; 3; 8; 2; 4; 3
   c) 24; 14; 41; 34; 26; 30; 25; 19; 27
   d) 190; 215; 187; 208; 212; 202

2. The heights, in centimetres, of boys in the first soccer team are: 175; 168; 175; 176; 173; 168; 169; 176; 169; 191; 176. Find the mean height of these boys.

3. A short test was marked out of 10. The marks of 14 learners are: 4; 5; 6; 7; 8; 8; 6; 9; 9; 2; 10; 3; 5; 6. Find the mean mark for this test.

4. The frequency table below shows the amount of pocket money, to the nearest Rand that Grade 10 learners are given each week. Calculate the mean amount of pocket money per week.

Pocket money (nearest Rand)	30	35	40	45	50
Frequency	5	5	10	8	2

5. For each set of data given in the frequency tables below, find the mean.

a)

Time taken to complete class work (minutes)	6	9	10	13	15
Frequency	4	4	5	4	3

b)

Age of learners (in years)	14	15	16	17	18
Frequency	2	3	10	15	10

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24QW 2. 24QX 3. 24QY 4. 24QZ 5. 24R2

Median

When data is arranged in ascending order, it is arranged from the smallest value to the biggest value (e.g. 2; 3; 4; 5; 6). When data is arranged in descending order, it is arranged from the biggest value to the smallest value (e.g. 6; 5; 4; 3; 2). The middle value in the set of data values is called the median. E.g. If you have numbers 2; 3; 4; 5; 6; 7, and 8, the median is 5.

We need to consider two cases when we find the median of data:

1. When there is an odd number of data values.
2. When there is an even number of data values.

Worked example 4: Finding the median with an odd number of values

QUESTION

Find the median of the numbers: 4; 6; 7; 4; 3; 4; 8; 2; 9; 7; 2.

SOLUTION

First we must arrange the numbers in ascending order i.e.:

2; 2; 3; 4; 4; 4; 6; 7; 7; 8; 9.

2	2	3	4	4	4	6	7	7	8	9
					↑					

The arrow indicates the middle position. There are 5 numbers on each side of this number (4).

Therefore 4 is the median of the set of the numbers.

Worked example 5: Finding the median with an even number of values

QUESTION

Find the median of the numbers: 4; 6; 4; 7; 2; 3; 8; 9; 7; 4

SOLUTION

First we must arrange the numbers in ascending order. i.e.:

2; 3; 4; 4; 4; 6; 7; 7; 8; 9.

2	3	4	4	4		6	7	7	8	9
					$\uparrow$					

The arrow indicates the middle position. There is no number in this exact position. So we take the number that is halfway between 4 and 6.

Therefore the median $= \frac{4+6}{2} = 5$

Mode

The mode is the data value that appears most often in a set of data. No calculation is needed to find or determine the mode. You just find the value that appears most frequently. E.g. If you have numbers 2; 5; 7; 7; 10; 12; 15, the mode is 7. If no number is repeated, then there is no mode for the list. You must also be aware that there can be more than one mode.

For grouped data, we use the **modal class.** This is the group or class that has the highest frequency.

Worked example 6: Finding the mode

QUESTION

1. Find the mode of the set of numbers: 4; 6; 7; 6; 3; 4; 8; 4; 2; 9.

2. Funeka decides to record the colours of schoolbags of everyone arriving at school. She writes down: 27 blue, 16 red, 43 white, 7 black, 16 green. What is the modal colour?

SOLUTION

1. The value 4 appears most often, therefore the mode is 4.
2. The modal colour is white.

Range

The range is a measure of spread because it tells you how spread out the data values are. The range is found by finding the difference between the largest value and the smallest value.

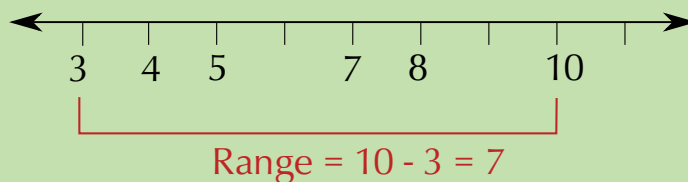
Range = highest data value - lowest data value.

Worked example 7: Finding the range

QUESTION

Find the range of the numbers 3; 7; 8; 5; 4; 10.

SOLUTION

The lowest value is 3, and the highest is 10, so the range is 10 - 3 = 7.

Note: It is important to remember to subtract the numbers and not leave the answer as 3 - 10 or 10 - 3.

Activity 12 – 4: Calculating the mean, mode, median and range

1. Find the mean, mode, median and range for each of the following data sets:

   a) 5; 7; 19; 24; 10; 17; 21; 6; 22; 5; 9

   b) 190; 215; 187; 208; 212; 202

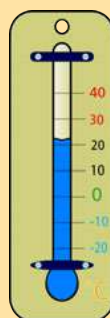
2. The heights, in centimetres, of the girls in the cross-country running team are 175; 168; 175; 176; 173; 168; 169; 176; 169; 191; 176 cm. Find the mean, mode, median and range of the height of these girls.

3. Find the mean, median, mode and range of each of the following data sets:

   a) 46; 32; 18; 6; 19; 32; 81; 24; 49; 33

   b) 124; 214; 341; 134; 126; 130; 325; 319; 227

4. Here is a list of the maximum temperatures for a week, in degrees Celsius:

   16; 3; 15; 25; 20; 19; 19

   a) Give the mean, median, mode and range of the temperatures.

   b) If the person who read the temperatures discovered that they had made a mistake and the 3 degrees was meant to be 23 degrees, how would this affect your summary of the data?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24R3 2. 24R4 3. 24R5 4. 24R6

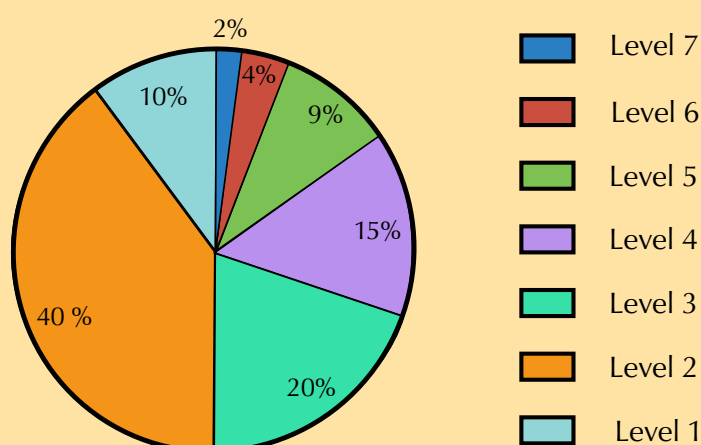
12.7 Representing data EMG76

Once a research question has been developed, we collect data. The next step is to classify and organise the data. This is then followed by summarizing the data using the measures of central tendency and spread. More importantly the data that has been collected, classified, organised and summarised needs to be represented and interpreted graphically. The following different types of graphical representations will be explained in this section: pie charts, histograms, single bar graphs, line graphs and broken line graphs.

Pie charts EMG77

Pie charts are best to use when you are trying to compare parts of a whole. They do not show changes over time. A pie chart is divided into sectors, usually labeled as percentages. Each sector represents a particular proportion of the data. Information can be easily read from a pie chart but contrary to that, it is difficult to identify the trend. This means that although it may be possible to use a pie chart to show the monthly rainfall of a particular town, it would be difficult to identify trends in the rainfall pattern.

Activity 12 – 5: Understanding pie charts

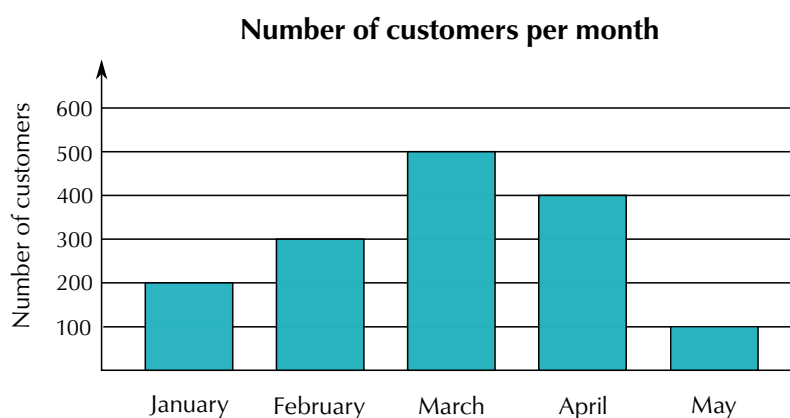
Consider the pie chart below and answer the questions that follow:

1. Which level did most of the learners obtain?
2. What was the percentage of learners who obtained this level?
3. Few learners achieved level 7. What was the percentage of learners at this level?
4. If there were 120 learners who wrote the examination, how many learners achieved level 4?

5. Write the ratio of learners who achieved level 3 to those at level 2 in its simplest form.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

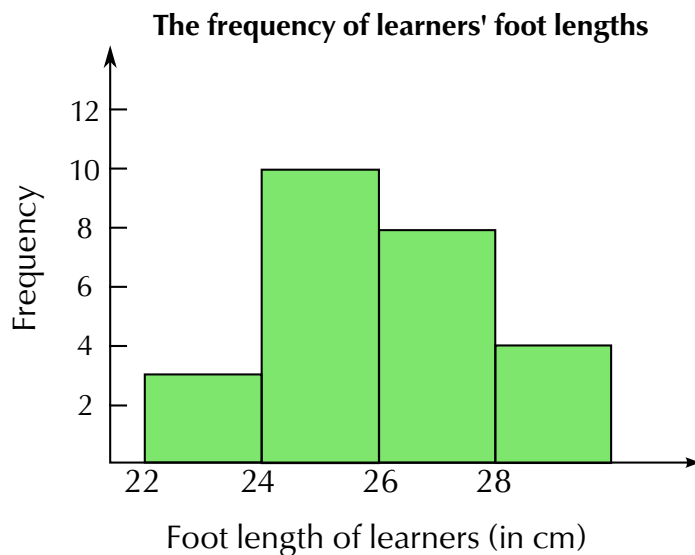
1. 24R7 2. 24R8 3. 24R9 4. 24RB 5. 24RC

Bar graphs EMG78

Bar graphs are used to display data that compared in categories. For example, every month for five months, a new store keeps count of how many customers visit the store. We can represent this on a bar graph as shown below:

Histograms EMG79

Histograms are different from bar graphs in that they usually represent continuous data. Data that is displayed on a histogram is also grouped. Consider the following table of the foot lengths of learners in a class, and the frequency of those lengths.

Foot length	Frequency
22 - 23,9 cm	3
24 - 25,9 cm	10
26 - 27,9 cm	8
28 cm and longer	4

We can represent this information on a histogram as follows:

Notice that unlike in the bar graph in the previous section, in the histogram, the bars are drawn next to each other - there are no spaces between them. This is to indicate that the data is continuous.

Worked example 8: Drawing bar graphs and histograms

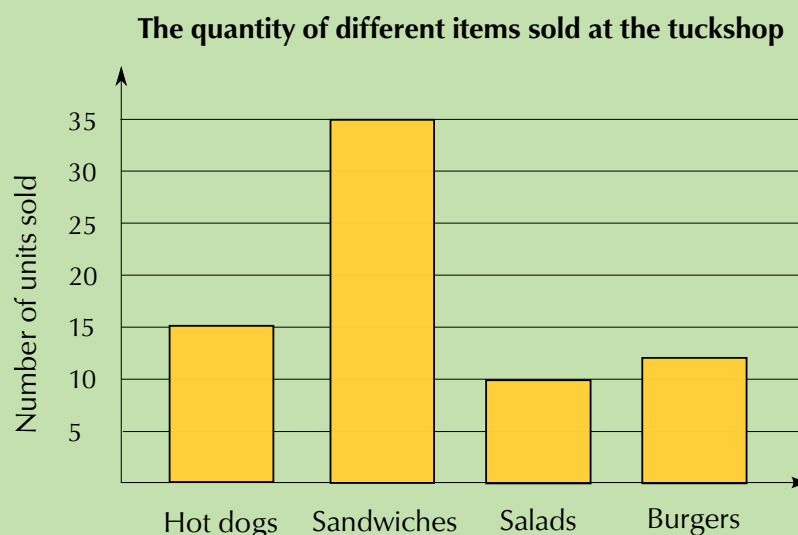
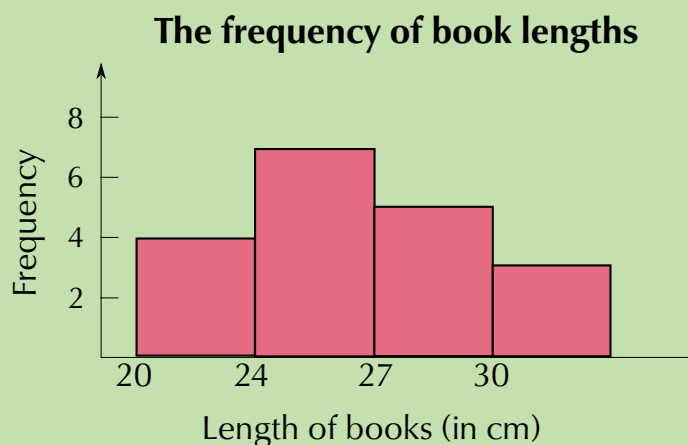
QUESTION

1. The school tuckshop keeps track of how many hot dogs, sandwiches, salads and burgers they sell at one break time. They have the data given in the table below. Draw a bar graph to represent this data.

Item	Frequency
Hot dogs	15
Sandwiches	35
Salads	10
Burgers	12

2. Lwanda measures the length of his school books (in cm) and draws up the frequency table below. Draw a histogram to represent this data.

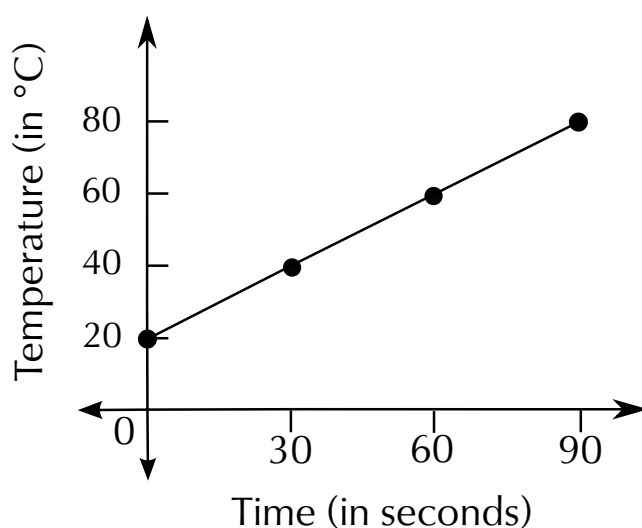
Length of Book	Frequency
20 - 23,9 cm	4
24 - 26,9 cm	7
27 - 29,9 cm	5
Longer than 30 cm	3

SOLUTION

Note from the previous worked example that when we draw both bar graphs and histograms, it is important to use an appropriate interval for the vertical axis. For example, using an interval of 100 would not be appropriate if our largest frequency is only 15, and using an interval of 1 would not be appropriate if we had a maximum frequency of 500 - it would make our graph very large and hard to read!

Line graphs EMG7B

In data handling we use line graphs to show the relationship between two quantities. The horizontal axis often represents time, as these kinds of graphs are particularly useful for showing changes over time.

For example, we can plot the manner in which the temperature of water in a pot being heated, increases, where the temperature is taken every 30 seconds.

Time (30 second intervals)	0	30	60	90
Temperature (°C)	20	40	60	80

Worked example 9: Representing data on a line graph

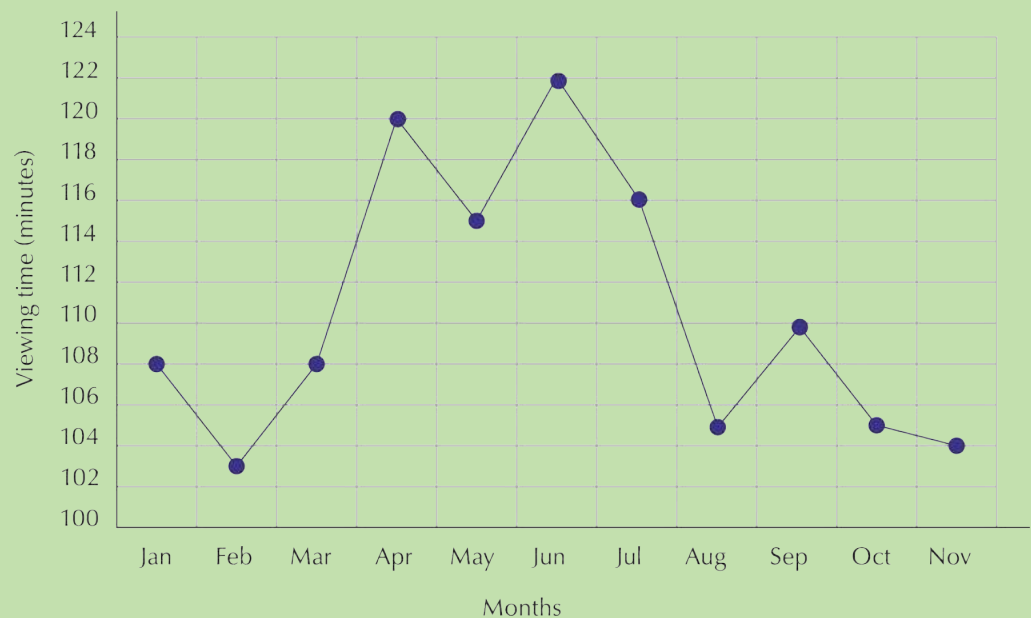
QUESTION

This table below shows the average number of minutes that Jabu spent watching TV from January to November last year.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Daily TV viewing time (min)	108	103	108	120	115	122	116	105	110	105	104

1. Plot this data on a set of axes.
2. Can you observe any trends or patterns in the data? Give some possible reasons for these trends.
3. Would you be able to represent this data in a bar graph?
4. What is the advantage of using a line graph to show this information?

SOLUTION

1. The points are plotted and connected with line segments.

2. You can see that Jabu's viewing time increases in April and again in June and slightly in September (perhaps due to school holidays). We also see decreases in his viewing time during February, May, August, October and November. These could be times when he was preparing for tests and exams.
3. Yes, it would be possible to represent this data in a bar graph; the number of minutes would be plotted as a bar for each month.
4. A line graph helps us to see trends because we can easily see the increasing or decreasing slope of each line segment in the graph.

Activity 12 – 6: Representing data

1. There are 300 learners at a school sports day. There are four sports teams, represented by red, blue, green and yellow. Someone records the colours of the T-shirts the learners are wearing.

Colour of T-shirt	Red	Blue	Green	Yellow
Frequency	75	93	78	54

   Represent this data in a pie chart.

2. The following list gives the weights of the learners in a class in kilograms.

   64; 83; 74; 77; 65; 55; 58; 61; 63; 98; 97; 53; 54; 102; 78; 82; 86; 95; 67; 72

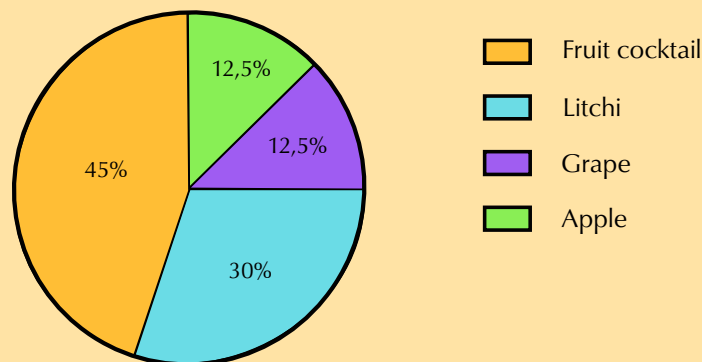
   a) Draw a frequency table to order the data, grouping it into 10 kg intervals.
   b) Use the frequency table to draw a histogram of the data.

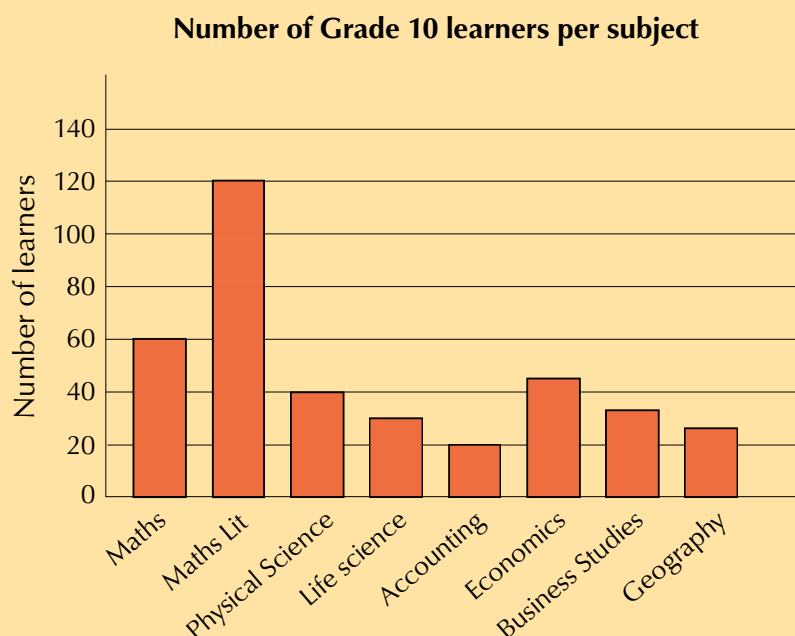
3. The following table gives the maximum temperature (in °C) for each month in a year.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max Temp (°C)	27	28	25	21	20	17	18	19	20	24	25	27

   a) Draw a line graph of this data.

   b) Describe the trends you see in the data.

4. Answer the questions below about the following pie chart. The pie chart shows the favourite fruit juice flavours of a group of 120 learners.

   a) Calculate how many learners chose each type of juice.
   b) In what way does the pie chart work better than a bar graph to represent this data?
   c) What information would a bar graph give you that this pie chart does not?

5. Look at the bar graph below and answer the questions that follow.

a) Does this graph tell us how many Grade 10 learners there are in total?

b) Can we assume that none of the learners who take Accounting take Geography?

c) A pie graph of this data would not make sense. Explain why.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24RD 2. 24RF 3. 24RG 4. 24RH 5. 24RJ

12.8 Analysing data EMG7C

The analysis of data is a continuous process that starts with the gathering of information. Analysis is best described as looking at information carefully and making a decision. After we have calculated the measures of central tendency and spread; and represented our data graphically, we can then comment on whether there are any trends or patterns in the data.

Activity 12 – 7: The whole data handling cycle

1. Design a data collection tool for recording the favourite sport of each of your classmates.
2. Record, organise, summarise and represent data on the favourite sport of each of your classmates.
3. Analyse the data to determine which sports are the most popular and which are the least popular.

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24RK 2. 24RM 3. 24RN

12.9 End of chapter activity EMG7D

Activity 12 – 8: End of chapter activity

1. In your school, collect (anonymous) data about learners' performance in Grade 10 Mathematical Literacy during the June 2012 examination. This must grouped be in terms of the levels that each learner has achieved, e.g Level 1 (0% - 29%), Level 2 (30% - 39%), and so on.
   a) Organise the data collected into a frequency table.
   b) Draw a histogram for the data collected, clearly label both axes and provide a meaningful heading.
   c) Refering to your histogram, clearly state which level most learners achieved, and what the reason for this trend could be.
2. After the first term Mathematical Literacy test was written at Lerato Secondary School, the Head of department sampled the scripts of 11 learners out of a class of 42. The results of these 11 learners were as follows (out of a total of 50 marks):

   22; 16; 45; 35; 40; 25; 42; 37; 41; 35; 27

   a) Arrange the set of marks in an ascending order.
   b) Determine the mean mark of the learners sampled.
   c) Determine the median mark of the learners.
   d) Determine the mode of the learners' marks.
   e) Calculate the range of the learners' marks.
   f) Convert the mean mark obtained above to a percentage (round off the answer to one decimal place).

3. Gaab is a citrus farmer who grows orange trees. After one season of growth, he measures the height of a sample of his trees. 50 trees were chosen and the results were recorded.

Height in cm	Number of trees
0 - 139	3
140 - 149	7
150 - 159	20
160 - 169	12
170 - 179	5
180 - 189	2
190 - 199	1
Total	50

   a) Use the above given information to draw a histogram. Give your graph a heading and label both axes.
   b) Use your histogram to determine the most common height interval.
   c) Which height interval was the least common?

4. A survey was done at Thahameso Secondary School to determine which subjects learners enjoyed the most. A total of 100 learners were interviewed. Look at the table below:

Subject	History	English	Maths Lit	Life Sciences	Life Orientation	Business Studies
Number of learners	30	20	18	12	6	14

   a) Draw a neat bar graph to represent the above information. Clearly label your graph with a heading. Label both axes.
   b) Which subject is the most popular and why do you think this is so?

5. The following table is a record of rainfall in mm for the town of Bethlehem during the month of January 2012. The data was collected over 7 days.

Day	1	2	3	4	5	6	7
Rainfall (mm)	15	25	10	40	20	20	45

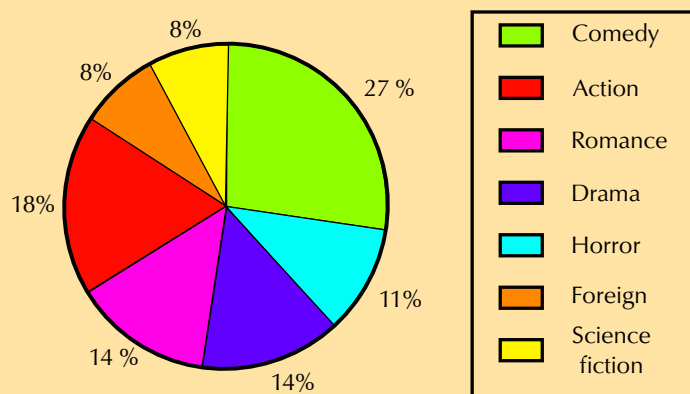
a) Determine the mean rainfall for the town of Bethlehem for the 7 days of observation.

b) Calculate the mode.

c) Determine the median rainfall for the town of Bethlehem for this week.

d) Calculate the range of the data.

e) Draw a neat line graph for the above data. Label both axes and give the graph a heading.

6. The pie chart below represents data about what kinds (or genres) of movies people watch. This data was gathered by asking a sample of people to answer questions and their choice of films. Study the pie chart carefully and answer the questions that follow.

a) What kind of movie is watched the most?

b) What percentage of all the movies watched is this (the most watched movie)?

c) According to the pie chart, some kinds of movies are watched the same amount. Which two pairs of movies are watched the same amount?

d) Supposed a sample of 200 people were interviewed.

  i. What is the number of people in the sample who watch action movies?

  ii. What is the number of people who watch science fiction movies?

e) Write the number of people who watch action movies and the number of people who watch science fiction movies as a ratio in its simplest form.

f) Give two reasons for why you think the percentages of people watching science fiction movies and foreign movies are the lowest.

7. Melissa measures her heart rate every half hour during the morning, and she draws up the following table of results:

Time of day	Heart rate
9:00 a.m.	65
9:30 a.m.	69
10:00 a.m.	72
10:30 a.m.	110
11:00 a.m.	90
11:30 a.m.	72
12:00 p.m.	75
12:30 p.m.	75
1:00 p.m.	69

a) Plot a line graph of the data in the table.

b) Describe what you notice about the graph.

c) Why do you think that her heart rate increases suddenly during the day?

Think you got it? Get this answer and more practice on our Intelligent Practice Service

1. 24RP 2. 24RQ 3. 24RR 4. 24RS 5. 24RT 6. 24RV
7. 24RW

1 Numbers and calculations with numbers

Activity 1 – 1: Different number formats

1. a) $1678,75
   b) $3 988 620,12
   c) 42 000 199
   d) 62,178 g
2. a) 53 211
   b) 167 890
   c) 90 001
   d) 1 123 456
   e) 4 879 120
3. A telephone number does not represent a value, rather, it is a unique label. We can only calculate with numbers that represent values.
4. Learner-dependent answer.
5. a) Learner-dependent answer.
   b) Learner-dependent answer.
   c) Learner-dependent answer.
   d) Learner-dependent answer.
   e) Learner-dependent answer.

Activity 1 – 2: Place value and ordering numbers

1. a) Twelve thousand, three hundred and forty-one.
   b) Two hundred and two million, eighty-two thousand and three.
   c) One million and ten.
2. a) 460 542
   b) 14 160 007
   c) 3 000 803 000
3. a) 1 694 212; 1 653 232; 612 005; 600 765; 161 280
   b) 1 808 765; 888 024; 818 123; 188 765; 82 364
   c) 3 402 987; 3 325 999; 3 233 987; 333 289; 315 672

Activity 1 – 3: Practise using your calculator

1. Learner-dependent answer.
2. This depends on how many digits can be viewed on the screen, but usually it's 9 999 999 999 - or nine billion, nine hundred and ninety-nine million, nine hundred and ninety-nine thousand, nine hundred and ninety-nine
3. Learner-dependent answer - different calculators have different variations on the "clear" keys. Generally, the "C" key clears everything that is not saved to the calculator's memory and "CE" clears the last step only.
4. Learner-dependent answer.
5. 1000
6. 100
7. The [C] key has cleared everything, while the [CE] key cleared the last input only.
8. Learner-dependent answer.
9. a) Does give -1000.
   b) Does give -1000.
   c) Does not give -1000.
   d) Does give -1000.
   e) Does give -1000.
   f) Does not give -1000.
   g) Does give -1000.
   h) Does not give -1000.

Activity 1 – 4: Using various methods to simplify calculations

1. a) 3955
   b) 1136
   c) 1680
   d) 2450
   e) 3255
   f) 2688
2. a) 393
   b) 333
   c) 1390
   d) 12 000
   e) 9000
   f) 7000
3. a) 645

b) 31

c) 56

d) 21

4. a) $(8 + 6) \times 5 = 70$

b) $8 + (6 \times 5) = 38$

c) $(8 + 3) \times (8 - 2) = 66$

d) $8 + (3 \times 8) - 2 = 30$

e) $15 + (2 \times 5) - 2 = 23$

f) $(15 + 2) \times (5 - 2) = 51$

g) $15 + 2 \times (5 - 2) = 21$

5. a) i. 140 ii. 1400 iii. 14 000

b) i. 6090 ii. 60 900 iii. 609 000

c) i. 2100 ii. 21 000 iii. 210 000

d) i. 100 010 ii. 1 000 100 iii. 10 001 000

Activity 1 – 5: Working with decimal fractions

1.

	Thousands	Hundreds	Tens	Units	tenths	hundredths
a)	1	4	5	6	3	
b)	4	6	0	1	9	1
c)				8	0	5
d)			3	1	7	
e)		4	5	6	2	

2. a) $<$

b) $<$

c) $>$

d) $<$

e) $<$

f) $>$

3. 49,1

4. a) 10,9

b) 7,0

c) 5,2

d) 89,9

e) 63,2

f) $-5,7$

g) $-8,4$

h) 9,99

5. a) 125,9
   b) 127,85
   c) 1,3
   d) 6,3
   e) 0,46
   f) 120
   g) 3400
   h) 3243
   i) 72 430
   j) 0,05298
   k) 0,37586
   l) 2,7457
   m) 0,0625

Activity 1 – 6: Converting between fractions and decimal fractions

1. a) 0,75
   b) 0,4
   c) 0,6
   d) 0,8
   e) 1
   f) 0,25

2. 0,333...

3.

Fraction	Fraction as tenths	Decimal fraction
two-thirds	Can't	0,6666666
one-quarter	Can't	0,25
three-quarters	Can't	0,75
one-fifth	$\frac{2}{10}$	0,2
two-fifths	$\frac{4}{10}$	0,4
three-fifths	$\frac{6}{10}$	0,6
four-fifths	$\frac{8}{10}$	0,8
one-sixth	Can't	0,166666666
one-eighth	Can't	0,128

Activity 1 – 7: Fractions, decimal fractions and positive and negative numbers

1. $1\frac{1}{10}$
2. $1\frac{1}{5}$
3. $1\frac{1}{2} = \frac{6}{4} = \frac{3}{4} + \frac{6}{4} = \frac{9}{4}$.
4.

Thousands	Hundreds	Tens	Units	tenths $\frac{1}{10}$
		6	4	8
	3	4	1	2
6	9	0	9	9

5. a) 3,8
   b) 1,3
   c) 5,25
   d) 4,5
6. a) $<$
   b) $<$
   c) $<$
   d) $>$
7. a) 46,0
   b) 9,99
8. R 4000 – (– R 2000) = R 6000

Activity 1 – 8: Squares, square roots and cubes

1. a) 40 000
   b) 170 569
   c) 9 610 000
   d) 6 589 489
2. a) 11 cm
   b) 25 cm
   c) 20 cm
   d) 120 mm
3. a) $14^3 = 2744$ mm^3
   b) $28^3 = 21\ 952$ mm^3
   c) $105^3 = 1\ 157\ 625$ mm^3
   d) $81^3 = 531\ 441$ cm^3

Activity 1 – 9: Rounding off in real-life situations

1. a) He should round up. If he rounds down he won't have enough tiles to cover the floor!
   b) $1245 \div 75 = 16{,}6$. So he should buy 17 packs.
2. a) 750 cm $\div$ 120 cm $= 6{,}25$. So 6 tables will fit along the wall.
   b) 6×120 cm $=$ 720 cm, so there will be 750 cm $-$ 720 cm $=$ 30 cm left over.
3. a) $231 \div 25 = 9{,}24$. 10 packs should be ordered.
   b) $10 \times 25 = 250$. $250 - 231 = 19$ spare books.
4. a) $500 \div 12 = 41{,}67$. She should buy 42 packs.
   b) $42 \times 12 = 504$. $504 - 500 = 4$ spare patties.
5. $70 \div 2{,}5 = 28{,}8$. So 28 parking spaces can be painted in the car park.

Activity 1 – 10: Working with ratios

1. a) Not equal
   b) Not equal
   c) Equal
   d) Not equal
2. a) 3 : 2 is equal to 30 : 20 so there are 20 male learners.
   b) $20 + 30$ learners $=$ 50 learners
3. a) 200 : 50
   b) 200 : 50 is equal to 2000 : 500, so there will be 2000 g of fruit and 500 g of nuts
   c) 200 : 50 is equal to 100 : 25 so there will be 100 g of fruit and 25 g of nuts.
4. 1 plus 7 parts equals 8 parts in total. 2000$\div$ by 8 is 250 ml. 1 : 7 is equal to 250 : 1750. So he must mix 250 ml of concentrate with 1750 ml of water.

Activity 1 – 11: Working with rates

1. R $15{,}95 \div 6 =$ R $2{,}668\ldots$ rounded off to R 2,67 per chocolate.
2. 1500 km$\div$ 18 h $= 83{,}33\ldots$ km/h. Round off to 83,33 km/h.

3. Nicola types 96 words ÷ 2 min = 48 words/min. Karen types 314 words ÷ 7 min = 44,857... words/min. Round off to a whole word: 45 words/min. Nicola is faster.

Activity 1 – 12: Finding unknown values in ratios and rates

1. a) $x = 30$
   b) $x = 3$
   c) $x = 35$
   d) $x = 30$
   e) $x = 40$
2. a) True
   b) True
   c) False
   d) False
   e) True
   f) False
   g) True
3. $\frac{\text{8 sentences}}{\text{1 paragraph}}$
4. a)

length (cm)	1	3	9	27	81
breadth (cm)	81	27	9	3	1

   b) $9\times$ 9 units

Activity 1 – 13: Calculating the percentages of amounts

1. a) $25\% = \frac{1}{4}$. $\frac{1}{4}$ of R 124,16 = R 124,16 ÷ 4 = R 31,04
   b) $50\% = \frac{1}{2}$. $\frac{1}{2}$ of 30 mm = 30 mm ÷ 2 = 15 mm
2. a) R 525
   b) 3 litres
   c) 8,25 kg
   d) R 12,69
   e) 18,9 m
   f) 663,6 km
3. a) 25%

b) 8,3%

c) 70%

d) 37,5%

e) 90%

f) 14,3%

Activity 1 – 14: Discounts and increases

1. New price is R 6,99 + 10% of R 6,99 = R 6,99 + 70 c (rounded off) = R 7,69 OR New price is (100 + 10)% of R 6,99 = 110% of R 6,99 = $\frac{110}{100} \times \frac{6,99}{1}$ = R 7,69 (rounded off)
2. You only pay 80% (100% – 20% discount). Thus: $\frac{80}{100} \times 189,901$ = R 151,92 OR 20% of R 189,90 = $\frac{20}{100} \times 189,901$. The discount is thus R 37,98. You pay R 189,90 – R 37,98 = R 151,92.
3. a) R 239,96 – R 59,75 = R 180,21

   b) R 299,50 – R 44,925 = R 1254,58

   c) R 9875 + R 790 = R 10 665

   d) R 15 995 + R 799,75 = R 16 794,75
4. a) $\frac{\text{R } 1360}{\text{R } 1523}$ = 89%. So discount is 100% – 89% = 11%

   b) $\frac{\text{R } 527,40}{\text{R } 586}$ = 90%. So discount is 100% – 90% = 10%

Activity 1 – 15: End of chapter activity

1. a) 6 650 232; 5 355 005; 3 695 212; 635 765; 365 280;

   b) 7812; 1278; 872; 78,2; 28,27; 27,28;

   c) 9988; 8903; 3989; 893; 89,89; 89,30

   d) 542 120; 120 345; 55 420; 12 345; 120,54
2. a) $(23 + 6) \times 5 = 145$

   b) $12 + (2 \times 82) = 176$ OR $12 + 2 \times 82 = 176$ (brackets not needed)

   c) $18 + (3 \times 17) = 69$ OR $18 + 3 \times 17 = 69$ (brackets not needed)

   d) $(18 + 3) \times 17 = 357$

   e) $(15 + 7) \times 5 = 110$

   f) $65 \times (2 + 5) = 455$

   g) $115 + (4 \times 12) = 163$ OR $115 + 4 \times 12 = 163$ (brackets not needed)
3. a) $275 \div 15 = 18,33\ldots$ He can only sell full punnets, so he must round down to 18.

b) 270 minutes is 4 hours and 30 minutes, but he rounds up to 5 hours, as he charges "per hour or part thereof". So he charges R 1000.

c) $82 \div 30 = 2$ remainder 22. They cannot turn away customers, so they should round up and run the ride 3 times.

d) $18 \div 3{,}2 = 5{,}625$. She should round down, as she can't put up a fraction of a line, and may need more line for knots and so on. So she can hang 5 lengths of line.

4. a) R 215,65

   b) R 329,25

   c) R 65,30

5. a) $\frac{1}{3} : 2 = 1 : 6 = 3 : 18$. So you need to add 18 cups of flour to 3 cups of sugar.

   b) There are 6 parts in the ratio, so 1 part $= 1350 \div 6 = 225$ learners do not have their own cell phone.

6. a) Shop: A R $29{,}95 \div 3 =$ R 9,98. Shop B: R $15{,}95 \div 2 =$ R 7,98

   b) Shop B.

   c) Shop A: R $9{,}98 \times 5 =$ R 49,90. Shop B: R $7{,}98 \times 5 =$ R 39,90

7. Work out what 100 g costs for each. A: R $8{,}50 \div 5 =$ R 1,70 and B: R $11{,}50 \div 7{,}5 =$ R 1,533 . . . So jar B is cheaper.

8. a) 24 001

   b) 364 500

   c) 18 650,3

   d) 990 130

   e) 529,8

   f) 6,99586

   g) 37,8441

   h) 0,7881

9. a) 14,90

   b) 29,07

   c) 78,23

   d) 209,84

10. R 210 000 – 12% = R 184 800

11. 1,5 kg – 15% = 1,275 kg. 1,5 kg – 1,275 kg = 0,225 kg of rice was used.

12. R 2786 – 11% = R 2479,54

13. R 175 000 – R 82 000 = R 93 000. $\frac{93\,000}{175\,000}\% = 53{,}14\%$

2 Patterns, relationships and representations

Activity 2 – 1: Interpreting graphs

1. a) Total distance is 16 km, Total time is 7 hours, 30 minutes
   b) 08:30 - 09:00, 10:30-11:30, 13:00-14:00
   c) G to H
2. a) No. At no point does the graph touch the horizontal axis
   b) Tuesday and Wednesday - her petrol consumption did not change at all, this suggests she did not use her car, and was therefore at home.
   c) Once, On Tuesday the amount of petrol in the tank spikes suddenly.
3. a) Continuous - there are no gaps in the graph, temperature is measured all day, from Friday to Thursday.
   b) 30°C, on Wednesday
   c) approximately -2°C, on Sunday.
   d) Minimum temperature is approximately 7°C maximum is approximately 30°C. 30°C $-$ 7°C = 23°C difference.
4. a) The highest point is on Tuesday (17 necklaces sold).
   b) Sunday.
   c) The graph is steepest between Monday and Tuesday, and there is a change from 8 to 17, so the biggest increase is here.
   d) Between Thursday and Friday - the graph is constant between these two points.
   e) There is a small increase in sales from Wednesday to Thursday - from 8 to 10 necklaces.
   f) There is a dotted line to indicate that the graph is not continuous between the plotted points. The sales are discrete points because Naledi only sells a whole number of necklaces each day.

Activity 2 – 2: Reading graphs

1. Time, on the horizontal axis, and the volume of water in Tumelo's bottle, on the vertical axis.
2. The volume of water is dependent on time, the independent variable.
3. It remains constant.
4. The amount of water in the bottle increases suddenly. This implies that Tulemo refilled his water bottle.
5. Between hour 8 and hour 10.
6. No. At no point does the graph touch the horizontal axis - i.e. at no point is the volume of water in the bottle 0 ml.

Activity 2 – 3: Linear relationships

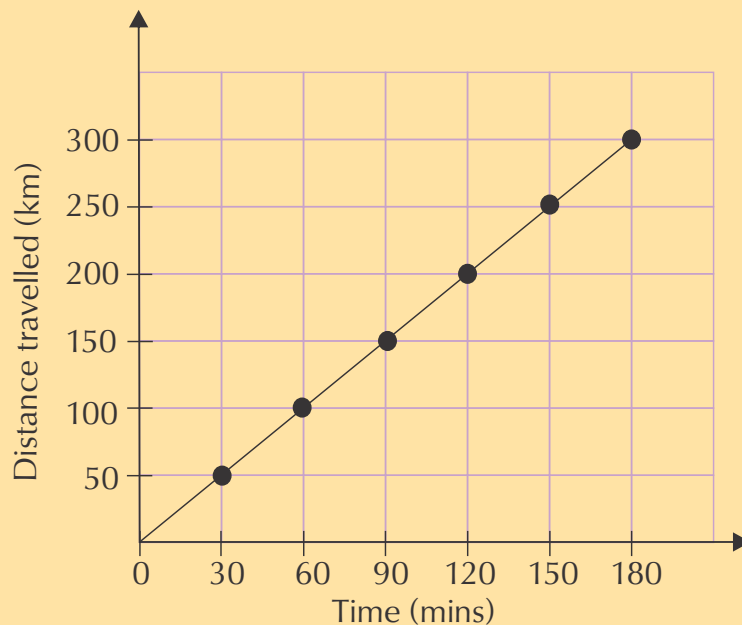
1. a)

Weight of potatoes (kg)	5	10	15	20	25	30
Cost (R)	100	200	300	400	500	600

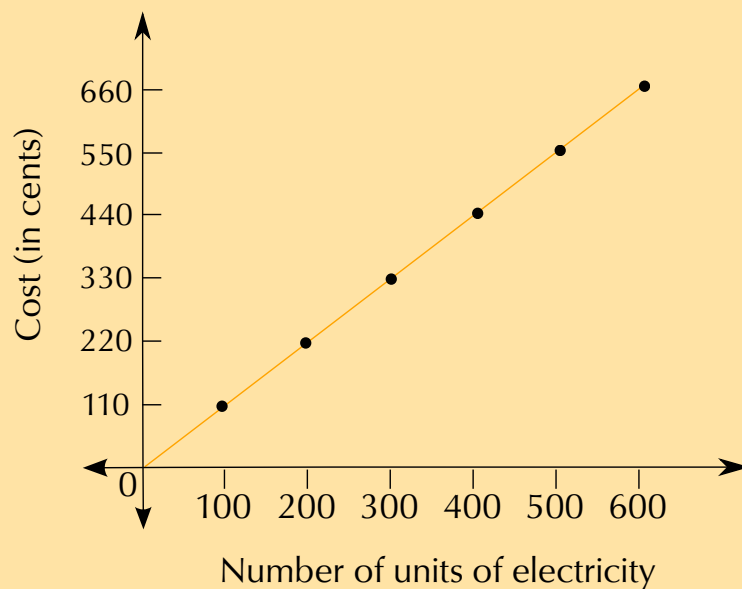
b) R 150

c) 15 kg

d) Weight is the independent variable. Price is the dependent variable.

2. a)

b) 100 km per hour.

3. a) at 0 units and 0 cents, at the intersection of the horizontal and vertical axes. We know this because we are given the minimum values, where both variables are equal to zero.

b)

c) Because every number of units of electricity used will be charged for. There is no quantity of electricity usage which does not have cost.

d) Cost increases as the number of units of electricity increases. The more electricity is used, the more you have to pay.

e) The graph is increasing. It has an upward slope, that indicates that the cost per unit increases as the number of units used increases.

Activity 2 – 4: Inverse proportion patterns

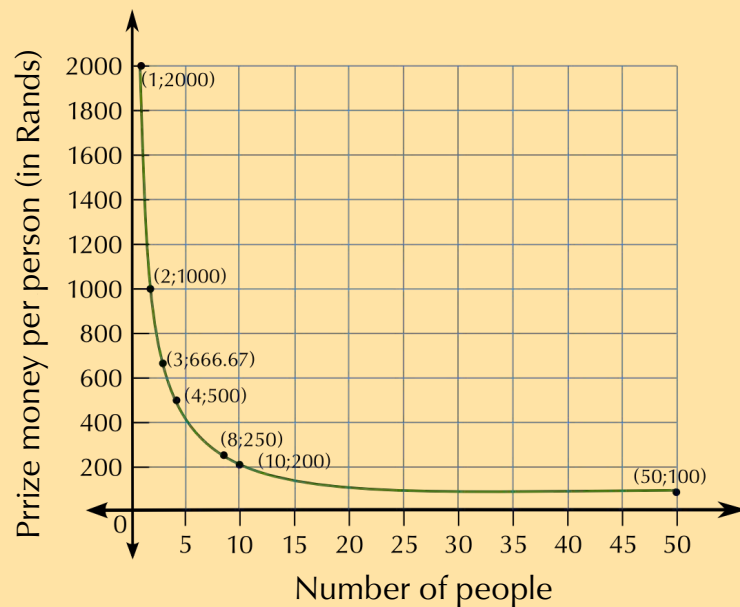
1. a) R 2000

   b) The larger the number of people in the group, the smaller the shared amount that each person will receive.

   c) An inverse proportional relationship.

   d)

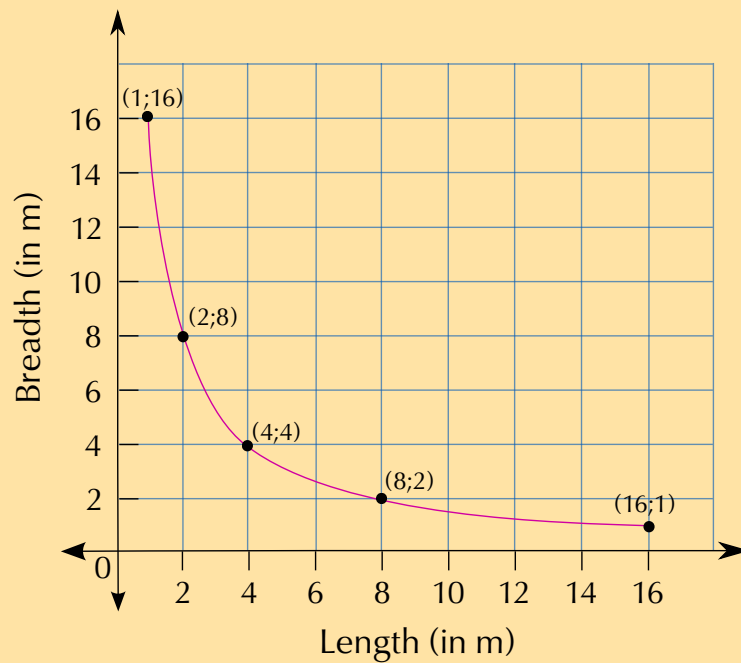
Number of people	1	2	3	4	8	10	50
Share of the prize money	2000	1000	666,67	500	250	200	100

   e)

2.

   a)

Breadth (m)	1	2	4	8	16
Length (m)	16	8	4	2	1

   b) No. Any two numbers whose product is 16 can be used, because length and breadth are continuous variables. Whole numbers will be easier to calculate and plot on a graph, however.

c)

Activity 2 – 5: Describing patterns

1. a) This number sequence starts at 2 and each term is multiplied by 2 to get the next term.

   b) This number sequence starts at 1 and 4 is added to each term to get the next term.

   c) This number sequence starts at 3 and 3 is added to each term to get the next term.

   d) This number sequence starts at 5 and 5 is added to each term to get the next term.

2. a) 1; 21; 41; 61;. . .

   b) 1; 4; 16; 64;. . .

   c) 20 000; 40 000; 80 000; 160 000;. . .

3.

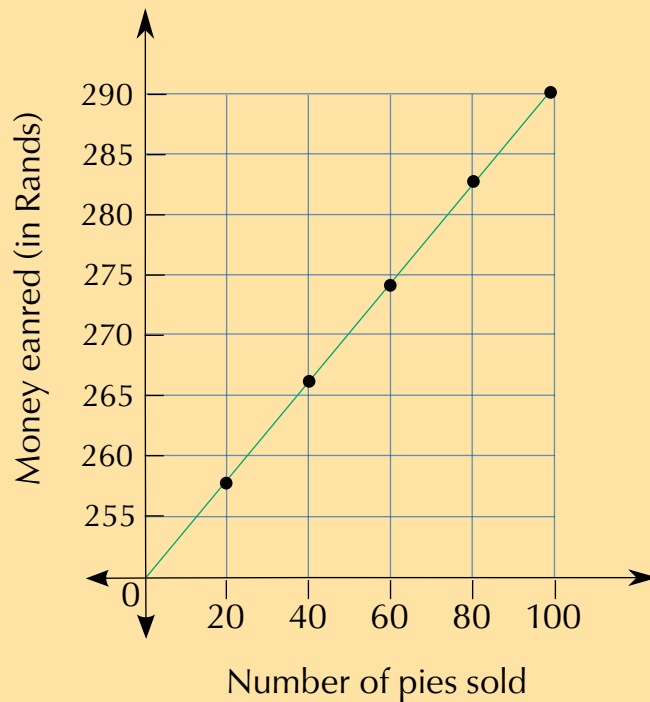
Position of term (n)	1	2	4	5	6	20
Value of term	5	14	32	41	50	174

Number sentence: $(n \times 9) - 4$. So 20th term $= (20 \times 9) - 4 = 176$.

4. a) Earnings = R 250 + (40 c $\times$ n), where n is number of pies he sells

   b)

Number of pies	20	40	60	80	100
Money earned (R)	258	266	274	282	290

c)

d) Because the graph is continuous, it will allow him to calculate how much money he earned for *any* number of pies. The precision with which he can read off the graph however, depends on the intervals between units on the graph's axes.

Activity 2 – 6: End of chapter activity

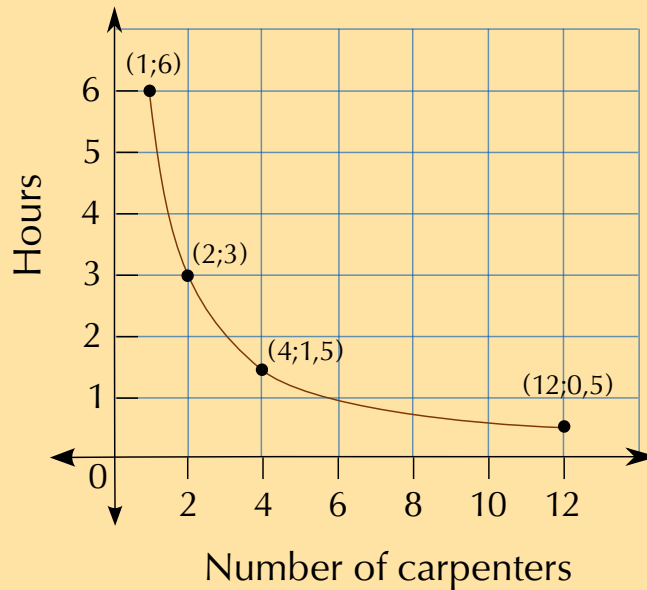
1. a) The relationship between distance from home and time.
   b) The longer Dikeledi cycles, the further she gets from home (so the greater the distance becomes), because she is cycling **away** from home.
   c) The longer Dikeledi cycles for, the closer she gets to home (so the smaller the distance becomes) because she is cycling **towards** home.
   d) 30 minutes
   e) 10 km
   f) 50 minutes
   g) i. between time 25 and 35 minutes
      ii. 3 km
      iii. Between time 15 minutes and 25 minutes she stopped cycling altogether.
      iv. 8 km
2. a) The number of carpenters and the hours required to make 20 tables.
   b) 3 hours.
   c) 1,5 hours

d) 30 minutes

e) Inverse proportional relationship.

f)

No. of carpenters	1	2	4	12
Hours to make 20 tables	6	3	1,5	0,5

g)

h) The line must be dotted, because there can only be a whole number of carpenters (this is a discrete variable).

3. a) You would add the cost of 10 games, at R 30 each.

b) Cost = R 30 × number of games.

c) Cost = R 150 + R 15 × 5 games

d) Cost = R 150 + R 15 × number of games

e) The number of games hired is the independent variable. How much Thomas pays for the games depends on how many games he hires.

f) The cost of hiring the games is the dependent variable.

g) The slope is positive, because the cost increases as you hire more games.

3 Conversions and time

Activity 3 – 1: Converting units of length.

1. 2,3 cm
2. 162 mm
3. 1,45 m
4. a) 5320 mm

   b) metres

5. 2,95 m
6. a) 402 cm
   b) metres
7. 6,473 km
8. a) 90 250 m
   b) kilometres
9. a) 1,89 km
   b) km
10. a) 7 820 000 mm
    b) km
11. 5,768 km
12. a) 4050 cm
    b) m

Activity 3 – 2: Converting units of volume

1. 0,33 ℓ
2. 3500 ml
3. a) 45 500 ℓ
   b) ℓ
4. a) 2 300 000 ml
   b) ℓ
5. 1,023 kl
6. a) 25 450 ℓ
   b) kilolitres

Activity 3 – 3: Converting units of weight

1. a) 5,6 kg
   b) kg
2. 2040 g
3. a) 150,7 t

b) tonnes

4. 3126 kg
5. 852 000 g
6. 3,5 t

Activity 3 – 4: Converting units for cooking

1. 2500 ml
2. 6 cups
3. 6 tbsp
4. 60 ml
5. 17 tsp
6. 35 ml
7. 4 cups and 4 tbsp
8. 1090 ml

Activity 3 – 5: Converting between 12-hour and 24-hour clock times

1. a) 9:00 p.m.
   b) 5:40 p.m.
   c) 11:40 p.m.
   d) 12:13 a.m.
2. a) 05:40
   b) 18:59
   c) 19:18
   d) 00:30

Activity 3 – 6: Converting units of time

1. a) $\frac{2}{3}$ of an hour

b) 2400 seconds

2. a) 72 hours
   b) 4320 minutes
   c) 259 200 seconds

3. a) 42 days
   b) 1008 hours

4. 60 hours

5. 1 minute, 10 seconds

6. 1 hour, 40 minutes

7. 1 day, 14 hours

Activity 3 – 7: Calculating elapsed time

1. 15:30

2. 5:50 p.m.

3. a) 20 minutes
   b) 6:55 p.m.

4. a) 21:20
   b) 1 hour, 30 minutes

5. 2 hours, 45 minutes

Activity 3 – 8: Creating your own calendar

1. Learner-dependent answer.

Activity 3 – 9: Writing up a timetable

1. Learner-dependent answer but an example:

   Sipho:

Time	Event
15:30 -16:30	Soccer practice
18:00	Feed dogs
19:00	Watch news for history assignment
19:30 - 20:15	Complete LO task
20:15	Do dishes

Mpho:

Time	Event
15:30 -16:30	Piano lesson
17:00- 17:30	Walk dogs
18:00	Set table for dinner
19:00	Clear table for dinner
19:15 - 19:45	Look through newspapers for geography homework
19:45 - 20:30	Study for Maths Lit test

Activity 3 – 10: End of chapter activity

1. a) 1,64 m

   b) 1500 mm = 1,5 m. The table is 1,64 m wide, so the table cloth will be 14 cm too short.

   c) 1500 mm = 150 cm. 150 cm ÷ 40 = 3,75 chairs. She can't have 0,75 of a chair, so she can fit 3 chairs along one side of the table.

2. a) 100 mm = 10 cm

   b) 10 cm ×25 bags = 250 cm Ribbon costs R 7,50 per metre and is only sold in full metres (not half metres).

   c) She will have to buy 3 metres.

   d) 3 × R 7,50 = R 22,50

3. a) 50 g = 0,05 kg

   b) 1000 g ÷ 50 g = 20 packets

   c) 1000 g chips : 400 g biscuits = 5 : 2.

   d) 20 × 500 g = 10 000 g = 10 kg

4. a) 1:10

   b) 3000 ml

   c) 3300 ml

   d) 3300÷ 200 = 16,5. So she will be able to fill 16 cups.

   e) $\frac{\text{400 ml concentrate}}{\text{4400 ml mixture}} = 0{,}09.\ 0{,}09 \times 100 = 9\%$.

5. a) 12 cups = 3000 ml

   b) 1 tbsp and 2 tsp

c) 4000 ml ÷ 250 ml = 8 cups of cake mixture

6. a) 12:40 p.m.
   b) 10:25

7. 45 + 50 + 67 minutes = 162 minutes = 2 hours, 42 minutes

8. Learner-dependent answer.

9. a) i. Saturday 21 September.
      ii. 9 days
      iii. 4 days
   b) Saturday 14 September.
   c) i. 9 hours ÷ 2 = 4,5 days. She should start studying 5 days before the exam.
      ii. 9 hours = 540 minutes.
   d) No - she will be on holiday.
   e) i. 5 days
      ii. 120 hours (depending on what time she leaves and comes back!)
   f) i. 1 day and 13 hours
      ii. Tuesday 24 September at 21:00.

4 Financial documents and tariff systems

Activity 4 – 1: Understanding a municipal bill

1. a) Electricity, water, refuse sewerage, municipal rates
   b) electricity
   c) EasyPay, direct deposit, ATM, Internet banking
   d) 12/07/2012
   e) The services may be disconnected.

2. a) −R 6305,77
   b) Because Mr Mukondwa has already paid more money into the account (credit) than he owed, so he is R 6305,77 in credit.
   c) No. There are no outstanding amounts listed for the previous 30, 60 or90 days.

3. a) 27 kl.
   b) 27 000 ℓ.

4. a) Either he used much more electricity than usual, or there was a mistake with his electricity meter reading.
   b) 1343,00 kWh
   c) Yes. He can check the meter himself and see if the reading corresponds to the reading the municipality took.
   d) He should call the municipality and query the bill.

Activity 4 – 2: Understanding a phone bill

1. R 99,00
2. 02/07/2012
3. 31/07/2012
4. HSDPA Voice Tariff
5. VAS Balance Notification
6. The month of July 2012
7. His cellphone number, his account number, the invoice number and the payment reference number.
8. Total without VAT = R 86,84. 14% of this = $86,84 \times \frac{14}{100} = 12,1576 \approx$ R 12,16.

Activity 4 – 3: Understanding till slips

1. A red T-shirt, 50% discount
2. No, full refunds are only available for non-sale items.
3. a) Yes - they were not sale items
   b) Before or on 18 April 2013
4. 2 packs of 6, so 12 eggs.
5. 2(R 5,99) + R 6,95 + 11,95 + 2(R 7,99) = R 46,86
6. VAT incl items total R 151,15. 14% VAT of this = R 21,16
7. VAT incl items total R 151,15. 14% VAT on this = R 21,16. Non-VAT items total R 46,86. VAT incl + 14% + VAT excl = R 219,17.

Activity 4 – 4: Understanding shop accounts

1. Her contact details only list her e-mail address, no physical or postal address.
2. R 4318,33
3. Jane's last payment was for R 400, on 25 August 2013.
4. 5 times
5. R 302,03 + R 171,74 + R 152,15 + R 279,67 + R 55,19 = R 960,78
6. At Nichol Way, JHB

7. Yes - on the 19th August she used her card at Cape Town Airport.
8. R 371,21 must be paid by 7 October 2013.
9. R 251,00
10. R 4949,47
11. 3% of R 400 $=$ R 400 $\times \frac{3}{100}$ $=$ R 400 $\times$ 0,03 $=$ R 12,00.

Activity 4 – 5: Calculating costs using given municipal tariffs

1. 140 $\times$ 129,05 c $=$ 18 067 c $=$ R 180,67
2. Block 1:140 $\times$ 129,05 c $=$ 18 067 c $=$ R 180,67.
   Block 2: 200,5 - 140 $=$ 60,5 kWh.
   60,5 $\times$ 134,65 c $=$ 8146,325 c $=$ R 81,46325.
   R 180,67 $+$ R 81,4572 $=$ R 262,13325 $\approx$ R 262,13
3. Basic cost: R 24,45.
   Block 1:140 $\times$ 129,05 c $=$ 18 067 c $=$ R 180,67.
   Block 2: 350 - 150,1 $=$ 199,99 kWh.
   199,99 $\times$ 134,65 c $=$ 26 928,6535 c $=$ R 269,286535.
   Block 3: 423 kWh - 350,1 kWh $=$ 72,9 kWh.
   72,9 $\times$ 134,65 c $=$ 9815,985 c $=$ R 98,15985.
   R 24,45 $+$ R 180,67 $+$ R 269,286535 $+$ R 98,15985 $=$ R 572,566385 $\approx$ R 572,57.

Activity 4 – 6: Interpreting and comparing graphs of a tariff system

1. Monthly subscription $+$ itemised billing $=$ R 122
2. R 1,95 $\times$ 2 $=$ R 3,90
3. After the first call, Alfred has used 2 of the first 5 minutes of calls. The next call will cost (3 $\times$ R 1,95) $+$ (1 $\times$ R 1,55) $=$ R 7,40
4. a) 9 minutes 25 seconds $=$ (9 $\times$ 60 seconds) $+$ 25 seconds $=$ 565 seconds
   b) 360 seconds $=$ 6 $\times$ 60 seconds. Calls to the same network are R 0,99 per 60 seconds so it will cost R 0,99 $\times$ 6 $=$ R 5,94
5. Alfred starts with R 140 worth of airtime. We know he has spent R 70,45 on calls. The local sms's are covered by his monthly contract so we do not deduct them from his airtime (he will have 15 free local sms's left.) The 5 international sms's cost 5 $\times$ R 1,20 $=$ R 6,00 and the 2 MMS's cost 2 $\times$ R 0,75 $=$R 1,50. Now we deduct all these costs from the initial amount or R 140: R 140 $-$ R 70,45 $-$ R 6,00 $-$ R 1,50 $=$ R 62,05. He has R 62,05 airtime left.

6. a) R 0,63
   b) No. SMS's currently cost him only R 0,60, so the bundled SMS's are more expensive.

7. The first 5 minutes cost: R 1,95 × 5 = R 9,75. This leaves him with R 140 − R 9,75 = R 130,25 airtime. The remaining minutes will cost R 1,55 each. R 130,25 ÷ R 1,55 = 84 minutes = 1 hour and 24 minutes.

Activity 4 – 7: Working with transport tariffs

1. a) 2 trips per day × 5 school days per week × 4 weeks = 40 trips per month
   b) 40 × R 4,00 = R 160,00
   c) R 160,00 - R 81,50 = R 78,50 cheaper.
   d) R 81,50 ÷ 40 trips = R 2,04.
   e) R 4,00 - R 2,04 = R 1,96 cheaper.

2. a) R 112,00
   b) R 112,00 × 0,20 = R 22,40. R 112,00 - R 22,40 = R 89,60

Activity 4 – 8: End of chapter activity

1. a) Johannesburg
   b) He paid R 3700,00 on 2013/06/25
   c) R 1172,33
   d) R 1646,76
   e) Because Simon has paid more money into his account than is due - he is in credit.
   f) R 1279,45 × 12 = R 15 353,40, or R 2 920 000 × R 0,052580 = R 15 353,40.
   g) Yes. He gets a R 65,73 deduction.
   h) No. The VAT is listed at 0%.
   i) R 379,86× 0,14 = R 53,18

2. a) September 2013
   b) 21 days
   c) Yes, they are VAT inclusive. Neotel must charge VAT on the cost of their services, and there is nothing in the invoice to indicate that VAT has not yet been added to the totals due.
   d) She paid R 771,18 on 26 September 2013

e) No - her payments are up to date.

f) She can make a cash deposit at Nedbank or she can pay via Electronic Fund Transfer (EFT)

g) She can call their customer care number, she can send a fax to them, she can e-mail them or she can use their website.

h) R 606,13 $\times$ 0,14 $=$ R 84,86 VAT.

3. a) With cash.

b) R 66,61

c) R 103,44

d) R 103,44 $\times$ 0,14 $=$ R 14,48

e) Total $=$ R 66,61 $+$ R 103,44 $+$ R 14,48 $=$ R 184,53

f) The total is rounded down to the nearest multiple of 5, to accommodate for the fact that we no longer have 1c or 2c coins in South Africa.

g) 500 g costs R 19,99, therefore 1 kg costs R 19,99 $\times$ 2 $=$ R 39,98

h) R 39,98 $\times$ 0,20 $=$ 7,996. R 39,98 - R 7,996 $=$ R 31,98.

4. a) Polokwane.

b) 3 times.

c) R 623,95

d) He paid R 623,95 into his account on 8 April 2013.

e) He can pay via EFT or cash deposit.

f) The payment is due on 31 May, so he has 21 days to pay his account. 21 days is 3 weeks.

g) R 676,66 $\times$ 0,14 $=$ R 94,73.

h) R 771,39 - R 350 $=$ R 421,39.

i) Yes - he has no overdue payments from previous invoices.

5. a) i. 2000 kWh $\times$ R 1,24566 $=$ R 2491,32. 9000 kWh $-$ 2000 kWh $=$ 7000 kWh.
7000 kWh $\times$ R 0,92405 $=$ R 6468,35.
R 2491,32 $+$ R 6468,35 $=$ R 8959,67

ii. R 8959,67 $\times$ 0,14 $=$ R 1254,35

iii. R 8959,67 $+$ R 1254,35 $=$ R 10 214,02

b) There is a minimum charge of R 187,3342.

c) i. First 2000 kWh: 2000 $\times$ R 1,4200 $=$ R 2840,00.
Next 8000 kWh: 8000kWh $\times$ R 1,0534 $=$ R 8427,20.
Last 1 kWh (over 10 000 kWh) $=$ 1000 kWh $\times$ R 1,4818 $=$ R 1481,80.
Total $=$ R 2840,00 $+$ R 8427,20 $+$R 1481,80 $=$ R 12 749,00

ii. The school could turn off lights when they aren't being used (e,g, at night). They could install solar panels. They could turn off the geysers at night, or install solar panel geysers to save electricity.

6. a) i. 540 seconds $=$ 9 minutes. 9 $\times$ R 0,34 $=$ R 3,06

ii. 540 seconds $=$ 9 minutes. 9 $\times$ R 0,17 $=$ R 1,53

b) i. National, off peak per minute rate, to a non-Neotel line is R 0,33.

ii. Yes. After hours and on weekends a call from a Neotel line to a Neotel line is free.

iii. 420 seconds = 6 minutes. Per minute rate from Neotel tell to Neotel, between 18h00 and 07h00 is free.

7. a) R 7,50

   b) R 147,00

   c) i. R 6,50 × 2 trips per day × 5 days = R 65,00 per week

   ii. Weekly ticket costs R 42,00. This is R 22 cheaper.

   iii. He makes 10 trips per week, and 1 month ≈ 4 weeks, so he makes 40 trips per month. R 126,00 ÷ 40 = R 3,15

   iv. R 6,50 − R 3,15 = R 3,35 cheaper

5 Measuring length, weight, volume and temperature

Activity 5 – 1: Measuring length and calculating cost

1. a) 90 × R 95,20 = R 8568,00

   b) 90 ÷ 1,5 = 60. He will need 60 poles.

   c) 60 × R 65 = R 3900,00

   d) R 8568,00 + R 3900,00 = R 12 468,00

2. a) The cloth is the same width (1 m + 20 cm + 20 cm) as the fabric sold. She will therefore need 3,4 metres of material to cover one table. 3,4 m × R 75,00 = R 225,00

   b) R 225,00 × 15 tables = R 3825,00

Activity 5 – 2: Calculating weight

1. 2,2 t = 2200 kg. 2200 kg ÷ 20 people = 110 kg each.

2. a) (50 × 80 kg) + (50 × 29 kg) = 4000 kg + 1450 kg = 5450 kg = 5,45 t.

   b) 4 t = 4000 kg. 4000 kg + 5450 kg = 9450 kg.

3. a) 80 kg

   b) Yes - he weighs less than 80 kg and has lost more than the minimum 5 kg.

4. a) 250 g × 25 = 6250 g = 6,25 kg.

   b) 15 boxes × 6,25 kg = 93,75 kg

Activity 5 – 3: Monitor your weight at home

1. Learner-dependent answer.
2. Learner-dependent answer.
3. Learner-dependent answer.

Activity 5 – 4: Calculating whether or not your school bag is too heavy

1. 9,9 kg
2. Yes. It weighs more than 9,9 kg.
3. 10,8 kg
4. No. It weighs less than 15% of her body weight.
5. Learner-dependent answer.
6. Learner-dependent answer.
7. Learner-dependent answer.
8. Learner-dependent answer.

Activity 5 – 5: Measuring weight and calculating costs

1. 2
2. $2 \times$ R 31,50 = R 63,00
3. R 41,75 $\times$ 1,5 kg = R 62,63
4. R 63,00 + R 62,63 = R 125,63

Activity 5 – 6: Measuring and comparing volume

1. 6×330 ml = 1980 ml = 1,98 litres
2. a) 30 litres $\times$ 0,75 = 22,5 litres
   b) 22,5 litres $\div$ 300 ml = 2250 ml $\div$ 300 ml = 6,8 cups = 6 full cups.
3. a) 2×5 ml = 10 ml.

b) 1 tsp = 5 ml.

c) 2 cups flour × 250 ml = 500 ml.

d) 100 ml ÷ 5 ml = 20 times.

e) $\frac{2 \text{ cups flour}}{30 \text{ cupcakes}} = \frac{3 \text{ cups flour}}{45 \text{ cupcakes}}$ so he will need 3 cups of flour.

Activity 5 – 7: Measuring volume and calculating costs

1. a) $1\frac{1}{3}$ cups = $\frac{4}{3}$. $\frac{4}{3} \times 250$ ml = 333 ml of milk.

   b) $\frac{330 \text{ ml}}{20 \text{ cupcakes}} = \frac{500 \text{ ml}}{30 \text{ cupcakes}}$. She will need 500 ml of milk.

   c) 1 bottle = R 8,50 (she will only use half).

2. a) 5 litres = 5000 ml. 5000 ml ÷ 250 ml = 20 cups.

   b) 20 cups × R 5 = R 100

   c) R 120 ÷ R 5 = 24. He would need to sell 24 cups just to recoup his costs.

Activity 5 – 8: Understanding temperature

1. 200°C − 120°C = 80°C

2. 100°C − 72°C = 28°C hotter

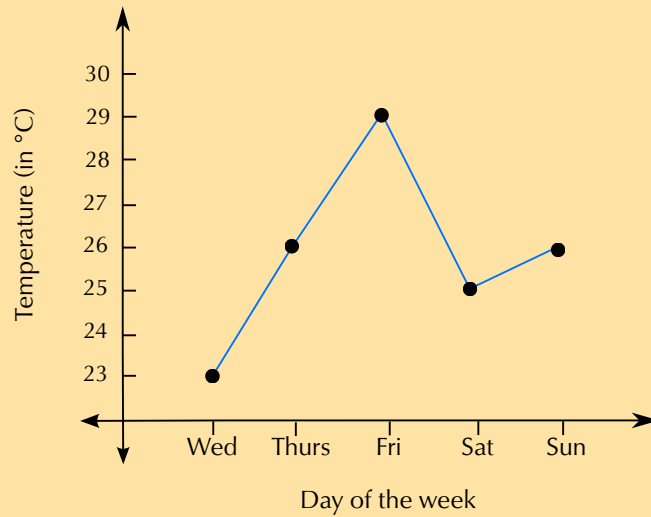
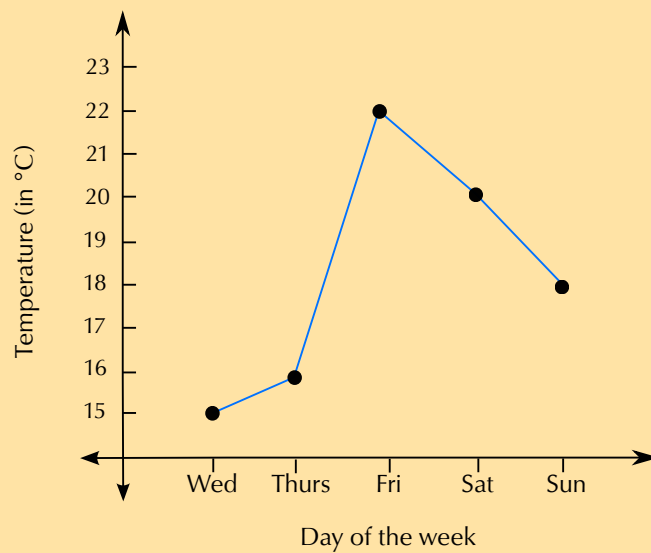
3. 23°C − 0°C = 23°C colder.

4. a) −5; −2; 0; 1; 3; 4; 6; 7; 8

   b) 8°C − (−5°C) = 13°C

5. a) Friday

   b) 29°C − 22°C = 7°C

   c) 18°C − 15°C = 3°C

f) No.

Activity 5 – 9: End of chapter activity

1. a) $60 \div 8 = 7{,}5$ cakes. They can't bake half a cake so they will have to bake 8.

   b) i. 9 cups.

   ii. 1 cake requires 2 cups = 250 ml of flour. 9×250 ml = 2250 ml = 2,25 litres

   iii. 1 cake requires 1 tsp = 5 ml. 9×5 ml = 45 ml of vanilla essence.

   iv. 45 ml $\div$ 25 = 1,8 bottles. They can't buy 0,8 of a bottle so they will have to buy 2 bottles.

   v. $2 \times$ R 7,85 = R 15,70

   vi. 5 eggs $\times$ 9 cakes = 45 eggs.

   vii. $45 \div 6 = 7{,}5$ boxes. They can't buy 0,5 of a box so they will have to buy 8 boxes. 6×8 boxes = 48 eggs. 48 - 45 = 3 eggs left over.

viii. R 8,40 × 8 boxes = R 67,20

c) 200 mm × 6 = 1200 mm = 120 cm

d) 700 g ÷ 8 = 87,5 g

e) i. 200°C - 180°C = 20°C

ii. The cake will flop, or it may burn.

2. a) 600 ml × 60 = 36 000 ml = 36 litres.

b) i. 40 litres ÷ 1,5 litres = 26,67 flasks. They can't have 0,67 of a flask so they will need 27 flasks.

ii. 27 flasks ÷ 15 flasks = 1,78 trips. They can't make 0,78 of a trip so they iwll have to make 2 trips.

3. a) 1,7 litres = 1700 ml. 1700 ml ÷ 200 ml = 8,5. So they can fill 8 full cups.

b) $\frac{200 \text{ ml}}{1700 \text{ ml}} = 0{,}12$ = 12 percent

c) 100°C - 65°C = 35°C

4. There are 4250 g bags in 1 kg, so 3 kg = 3 × 4 = 12 bags. 12 × R 5,49 = R 65,88

5. a) 60 × 300 g = 18 000 g = 18 kg

b) 18 000 g ÷ 500 g = 36 boxes.

c) 36 boxes × R 3,99 = R 143,64

6. a) 5 m = 5000 mm. 5000 mm ÷ 600 mm = 8,33. So they can cut 8 whole pieces of ribbon.

b) R 6,99 × 5 m = R 34,95

7. a) Thursday - the weather will be warmest for an outdoor event.

b) 14°C.

c) 26°C.

d) 19°C − 14°C = 5°C.

6 Scale, maps and plans

Activity 6 – 1: Using the bar and number scales

1. 5 cm × 100 = 500 cm = 5 m

2. 12 cm × 20 = 240 cm = 2,4 m.

3. 10 cm ÷ 1 cm = 10 segments. 10 segments × 15 m = 150 m

4. 15 cm ÷ 2 cm = 7,5 segments. 7,5 segments × 100 m = 750 m.

Activity 6 – 2: Using the number scale

1. Width and length of the school hall on the map is 5 cm.
   5 cm × 500 = 2500 cm = 25 m.
2. Width of the toilet block on the map is 2 cm.
   2 cm × 500 = 1000 cm = 10 m.
3. Distance between the science and maths buildings on the map is 1 cm.
   1 cm × 500 = 500 cm = 5 m.

Activity 6 – 3: Using the bar scale to estimate actual length

1. 1 cm on a ruler = 20 cm on the ground.
   Width of bookshelf is 7 cm.
   7 cm ÷ 1 cm (length of segment) = 7 segments of bar scale.
   7 segments × 20 cm = 140 cm = 1,4 m.
   The bookshelf is 1,4 m wide.
2. 1 cm on a ruler = 20 cm on the ground.
   Width of chair is 3,5 cm. 3,5 cm ÷ 1 cm (length of segment) = 3,5 segments of bar scale.
   3,5 segments × 20 cm = 70 cm.
   Length of chair is 4 cm. 4 cm ÷ 1 cm (length of segment) = 4 segments.
   4 segments × 20 cm = 80 cm.
3. 1 cm on a ruler = 20 cm on the ground.
   Length of left hand window is 5 cm.
   5 cm ÷ 1 cm (length of segment) = 5 segments of bar scale.
   5 segments × 20 cm = 100 cm = 1 m.
   Length of bottom window is is 7 cm.
   7 cm ÷ 1 cm (length of segment) = 7 segments of bar scale.
   7 segments × 20 cm = 140 cm = 1,4 m.

Activity 6 – 4: Drawing a scaled map

1. **Room real measurements**:

   width 3,5 m = 350 cm

   length 4 m = 400 cm

   Scale drawing:

   350 ÷ 50 = 7 cm

   400 ÷ 40 = 8 cm

   Bed real measurements:

   Width = 92 cm

Length = 188 cm

Scale drawing:

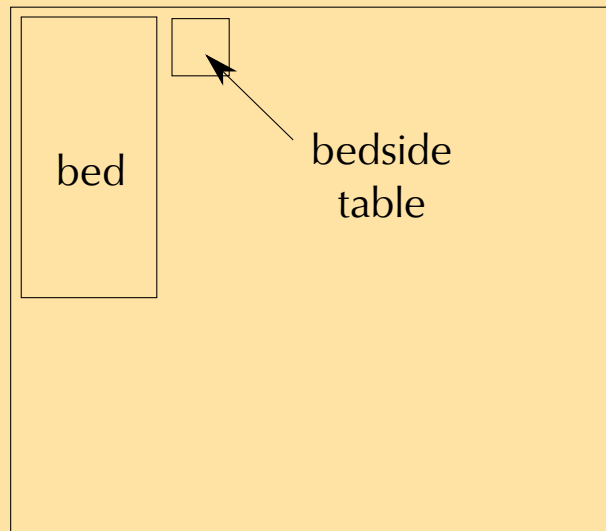
92 cm ÷ 50 = 1,84 cm

188 cm ÷ 50 = 3,76 cm

Bedside table real measurements:

400 mm

400 mm ÷ 50 = 8 mm

Scale drawing:

Activity 6 – 5: drawing scaled maps

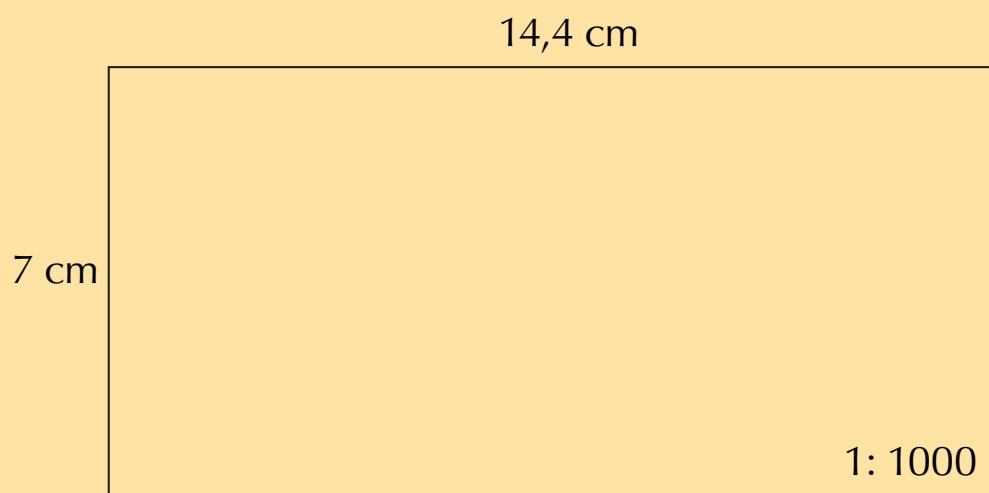
1. Learner-dependent answer.

Activity 6 – 6: Using the bar scale and directional navigation on a school ground plan

1. Width = 50 mm. Length = 100 mm.
2. 10 mm on ruler = 10 m on the ground. Width = 50 mm. 50 mm ÷ 10 mm (length of one segment of bar scale) = 5 segments. 5 segments × 10 m = 50 m. Length = 100 mm. 100 mm ÷ 10 mm (length of 1 segment) = 10 segments. 10 segments × 10 m = 100 m.
3. Science.
4. Mathematics.

5. Walk out of the Science classroom towards to sports field. Turn left, and walk along the edge of the field towards to school hall building. At the school hall, turn right. At the first opportunity, turn left (before the maths classrooms) and walk past the maths building. Then turn right and walk straight towards the tree. At the tree, turn left. The tuckshop will be the building in front of you.

Activity 6 – 7: Understanding a stadium seating plan

1. A player at Point X would be standing on the field, near the left hand side goal posts, and the Category 5 seats in Block G of the South Stand ramp seating.
2. The seats are colour-coded and categorised by price.
3. The West Stand has the most Category 3 seats. It is on the left of the stadium, between the North Stand and the South Stand.
4. Walk behind the East stand seating, with the stadium on your right. Then turn right and walk straight to the South Stand Ramp seating.
5. The hot dog stand at Point Z is in the top-left corner of the diagram. It is between the West and North Stands.
6. Walk behind the West stands (with the stands on your left). Turn left at the end of the stands, and walk straight to the edge of the South Stand ramp seating. Walk between the South Stand Ramp seating and South Stand Seating Level 1, past Blocks H, G, F, E, D, C and B. Block A (category 5) is on your left, at the end of the South Stand Ramp Seating.
7. Width = 70 m = 7000 cm. 7000 cm ÷ 1000 = 7 cm.
   So scaled width is 7 cm.
   Length is 144 m = 1440 cm.
   1440 cm ÷ 1000 = 14,4 cm.
   So scaled length is 14,4 cm.

(Note: above image not to scale but dimensions given are correct).

Activity 6 – 8: Navigating a shopping mall

1. Shop 35: CNA
2. Woolworths is Shop 51 on the ground floor.
3. Yes - there are stairs indicated on the map.
4. Near Entrance 5.
5. 1. CNA: Go straight towards Shop 29. Turn right, go left around the corner at Shop 31. Go straight. CNA will be on your left. 2: Pick n Pay: Go straight passing shops G07 - G02 on your left. Turn left into the entrance of Pick n Pay.
6. Go straight, turn left at Shop 18, in front of the stairs. Walk past shops 18 - 23 (following the mall as it curves to the right). Turn slightly left towards Pick 'n Pay. Just before Pick 'n Pay, turn right, between shops 28 and 29. Go straight down this passageway, the toilets are at the end.
7. Go straight, keeping to the left of the escalators in the middle. Pass the entrance to Woolworths on your left. Pass shops 53 - 56 (on your left) and then turn left in front of the escalators/stairs. Go straight, passing shops G59, 58 and 57. Dis-Chem will be in front of you.

Activity 6 – 9: End of chapter activity

1. a) i. $(8\text{ cm} \times 5\text{ cm}) \times 30 = 240\text{ cm} \times 150\text{ cm} = 2{,}4\text{ m} \times 1{,}5\text{ m}$
      ii. $(2{,}3\text{ cm} \times 2{,}3\text{ cm}) \times 30 = 69\text{ cm} \times 69\text{ cm} = 0{,}69\text{ m} \times 0{,}69\text{ m}$
      iii. $(3\text{ cm} \times 7\text{ cm}) \times 30 = 90\text{ cm} \times 210\text{ cm} = 0{,}9\text{ m} \times 2{,}1\text{ m}$
   b) $(15\text{ cm} \times 13\text{ cm}) \times 30 = 450\text{ cm} \times 390\text{ cm} = 4{,}5\text{ m} \times 3{,}9\text{ m}$
   c) The door is in the corner of the room, between the window and the cupboard.
   d) No. We are not given any information about the height of the windows. We can only calculate how long they are.
   e) Top window = 7 cm long. $7\text{ cm} \times 30 = 210\text{ cm}$. $210\text{ cm} \times 2 = 420\text{ cm}$. Left window = 5 cm long. $5\text{ cm} \times 30\text{ cm} = 150\text{ cm}$. $150\text{ cm} \times 2 = 300\text{ cm}$. $420\text{ cm} + 300\text{ cm} = 720\text{ cm}$ of material for both curtains.
   f) Learner-dependent answer.
   g) i. $1{,}8\text{ m} = 180\text{ cm}$. $180 \div 30 = 6\text{ cm}$ on scale map. $1{,}2\text{ m} = 120\text{ cm}$. $120\text{ cm} \div 30 = 4\text{ cm}$ on scale map. So diagram will be a rectangle that is $6\text{ cm} \times 4\text{ cm}$.
      ii. Yes - the dimensions of the carpet are smaller than the dimensions of the room.
2. a) i. Dimensions $= 3\text{ cm} \times 6\text{ cm} = 2\text{ segments} \times 4\text{ segments} = 6\text{ m} \times 12\text{ m}$.
      ii. Dimensions $= 3\text{ cm} \times 7\text{ cm} = 2\text{ segments} \times 4{,}66667\text{ segments} = 6\text{ m} \times 14\text{ m}$
      iii. Dimensions $= 3\text{ cm} \times 3\text{ cm} = 2\text{ segments} \times 2\text{ segments} = 6\text{ m} \times 6\text{ m}$

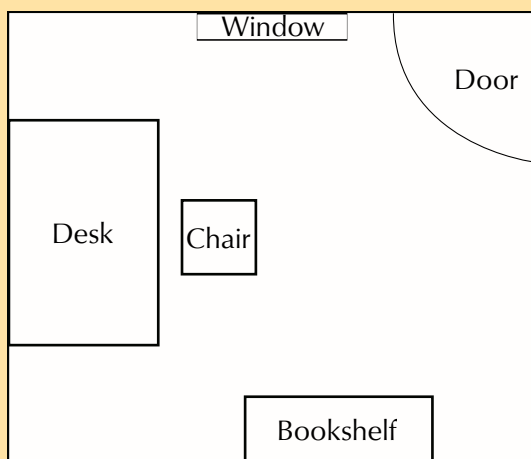
b) Pool is 6 m × 12 m. So fencing is (6 + 1,5 m) + (12 + 1,5 m) = 21 m

c) The pool is in the corner of the property, by the side of the community hall, overlooking the lawn and the playground.

d) Learner-dependent answer, but one option would be to the right of the lawn - there is space and it would not be in the way of any entrances/through-fares.

e) Dimensions = 3 cm × 7 cm = 2 segments × 4,66667 segments = 6 m × 14 m. So a 7 m × 11 m room would not fit into the hall.

f) Learner-dependent answer.

3.

Room: 6 cm × 7 cm. Window: 2 cm wide. Door: 2 cm wide. Desk: 2 cm × 3 cm. Chair: 1 cm × 1 cm. Bookshelf: 2,5 cm long.

4. a) Because there are entrances to the theatre on either side of the row.

b) Entrance 1. It is closest to seat C17.

c) C13

d) 6 rows

e) 19 + 20 + 20 + 20 + 20 + 20 + 20 + 19 + 18 + 19 + 20 + 15 + 16 + 5 + 5 = 256 seats

f) E14

g) $\frac{30}{256} = 0{,}1171\ldots$
$0{,}1171\ldots \times 100 = 11{,}7\%$

h) These rows of seats are in the balcony.

i) No. There is a short flight of stairs between them.

j) There is nothing on the seating plan to suggest that they are.

k) Number of balcony seats = 19 + 20 + 15 + 16 + 5 + 5 = 80. So 256: 80

l) $\frac{4}{5}$ of 256 = 204 seats booked. So there will be 51 seats available.

m) 30 × R 200 = R 6000. 10% of R 6000 = R 600. So the tickets will cost R 6000 - R 600 = R 5400.

5. a) Through the tunnel, in the middle of the field, under Block 6.

b) Clockwise.

c) The South Entrance.

d) It is in the corner of the stadium, between the main entrance and the east entrance

e) 11 + 12 = 23 Blocks.

f) 17 red blocks out of 71 blocks in total. $\frac{17}{71} \times 100 = 23{,}9\%$

g) If the friend is in Block 25, then the blue blocks are to their left, along the left side of the field.

h) i. Total duration of match = 90 minutes. 18:30 + 90 minutes = 20:00

ii. In the orange blocks.

6. a) The seats in the purple blocks.

b) 3 × R 300 = R 900

c) 3 × R 250 = R 750

7. a) Collect or send post.

b) Two - one between shops 106 and 107 (behind Edgars) and the other next to shop 171 and Clicks.

c) Walk straight along the mall. Pass Woolworths and CNA on your left. Follow the mall to the right. Pass the circular stairs and toilets on your right. Truworths with be in front of you, to your left.

d) Entrance 5 is closest to Checkers and Ackermans.

e) Learner-dependent answer, but generally somewhere central and easy to find.

f) There are stairs and an escalator indicated on the map, and the entire map is for the lower level.

7 Probability

Activity 7 – 1: Becoming familiar with the probability scale

1. a) Learners should come up with their own meaningful descriptions here.

b) Learner-dependent answer.

c) It is useful for learners to have a discussion about this to help them see that the descriptions are somewhat subjective.

d) Learner-dependent answer.

2. a) At 0,1 on the scale.

b) At 0,8 on the scale.

c) At 0,05 (unlikely) on the scale.

d) Close to zero on the scale.

3. a) 0,25; 25%

b) 0,8; 80%

c) 0,05; 5%

d) 0,03; 3%

e) 0,86; 86%

4. Learner-dependent answer. Encourage learners to discuss the fact that will probably give different answers if they use words, while using a number ensures that everyone has the same understanding.

Activity 7 – 2: Experimenting with games of chance

1. a) Learner-dependent answer.

   b) Learner-dependent answer. Learners may find it quite confusing that they do not get 50% Tails.

   c) i. Learner-dependent answer.

      ii. Learner-dependent answer.

      iii. Learner-dependent answer.

   d) Learner-dependent answer. We expect that a higher number of trials gives an answer closer to 50%. Allow plenty of time for a class discussion about this.

   e) Learner-dependent answer. Some learners may realise that the frequency of Heads will be complementary to the frequency of Tails (the two totals together equal 1 or 100%).

2. a) $\frac{1}{6}$

   b) Learner-dependent answer.

   c) Learner-dependent answer.

   d) Learner-dependent answer.

   e) Learner-dependent answer. Here again, learners will see that the frequency is different to the actual probability.

Activity 7 – 3: More games of chance

1. a) 1; 2; 3; 4; 5; 6; 7; 8

   b) 1 in 8 or 12,5% or 0,125

   c) The chance is the same, as there are the same number of even numbers and odd numbers on each type of dice.

2. a) Learner-dependent answer.

   b) Learner-dependent answer.

   c) Learner-dependent answer.

Activity 7 – 4: Fair and unfair games

1. a) Learner-dependent answer.
   b) Learner-dependent answer.
2. Learner-dependent answer.
3. Learner-dependent answer.

Activity 7 – 5: Calculating combined outcomes

1. a) Four possible outcomes.
   b) One possible outcome.
   c) 1 in 4 or $\frac{1}{4}$
   d) Yes.
   e) There are two ways of getting this: H; T or T; H.
   f) It is twice as likely to get one Heads and one Tails, because there are two possible ways of getting this and only one way of getting H; H.
2. a) 25
   b) 6
   c) $\frac{6}{25}$
   d) There are 9 possible outcomes out of 25, so the probability is $\frac{9}{25}$.
3.

	H	T
H	H; H	T; H
T	H; T	T; T

   a) There are four possible outcomes.
   b) One of the outcomes is (H; H).
   c) Two of the outcomes have one H only.
   d) One of the outcomes is (T; T).

Activity 7 – 6: Working with weather predictions

1. Learner-dependent answer.
2. Learner-dependent answer.
3. The prediction is based on past experience with similar weather conditions, and is not always correct.

4. Weather forecasters look at the weather characteristics (temperature, pressure, humidity, etc.) and compare it to their accumulated data about weather patterns. Then they make a prediction based on this.

5. Forecasters know that it rained on 80% of the days in the past with similar weather conditions, but they can only state a probability, not exactly what will happen. There is also a 20% probability of no rain.

Activity 7 – 7: Weather predictions

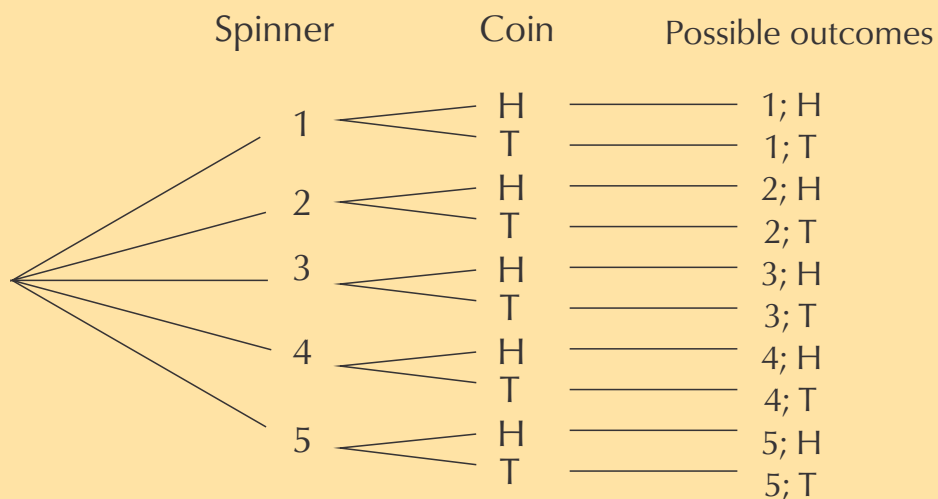
1. The fire risk probability depends on different aspects of the weather - primarily the probability of rain and high wind speeds. For example, if it has been very dry, and it is predicted that it will be windy, the risk of fire increases. If there is a 90% chance of rain predicted, the risk if fire is reduced.

Activity 7 – 8: End of chapter activity

1. a) Learner-dependent answer.
   b) Learner-dependent answer.
   c) Learner-dependent answer.
   d) Learner-dependent answer.
   e) Learner-dependent answer.

2.

Fraction (simplest form)	Decimal fraction	Percentage
$\frac{3}{4}$	0,75	75%
$\frac{3}{10}$	0,3	30%
$\frac{1}{10}$	0,1	10%
$\frac{9}{10}$	0,9	90%
$\frac{1}{8}$	0,125	12,5%

3. a) 2; 4
   b) 1; 3; 5
   c) No, there is a higher chance of getting an odd number, because there are more possible outcomes for odd numbers.
   d) The game would be unfair if a player has a small chance of winning, for example, if they win only if they get five. It would also be unfair if they win only if they get an even number.

4. a)
   b) Ten
   c) Only one.
   d) One in ten or $\frac{1}{10}$
   e) Two: 2; H and 4; H
   f) The probability is 2 in 10, which simplifies to 1 in 5 or $\frac{1}{5}$

8 Personal income, expenditure and budgets

Activity 8 – 1: Personal income

1. Fixed: basic salary, allowances for cell phone and travel. Variable: commission. Occasional: hourly fee for band performances.
2. Total Income earned $= [(4 \times 5) \times$ R 20 $+ (4 \times 10) \times$ R 30 $+ (2 \times 8) \times$ R 40]
   $=$ [R 400 $+$ R 1200 $+$ R 640] $=$ R 2240 / month

Activity 8 – 2: Personal expenditure

1.

Clothes	30% × R 1200 = 0,30 × R 1200 = R 360
Entertainment	10% × R 1200 = 0,10 × R 1200 = R 120
Savings	10% × R 1200 = 0,10 × R 1200 = R 120
Charitable organisations	25% × R 1200 = 0,25 × R 1200 = R 300
Transport	12% × R 1200 = 0,12 × R 1200 = R 144
Sweets and cool drinks	13% × R 1200 = 0,13 × R 1200 = R 156
Total:	100% = R 1200

Activity 8 – 3: Managing a personal monthly budget

1. High priority: Rent, water and lights, groceries, taxi transport, bank charges, medicine, cell phone contract, instalment on DVD player. Low priority: Clothing, satellite TV subscription, magazines, entertainment.
2. Variable expenses include clothing, water and lights, taxi transport, groceries, magazines, entertainment. So: R 260 + R 280 + R 900 + R 940 + R 180 + R 340 + R 580 = R 3480
3. a) His rent could increase. The cost of his medicine may increase. The cost of taxi transport could increase.

   b) He could reduce his spending on clothing, entertainment and magazines, and possibly cancel his satellite subscription.
4. Jacob should finish paying for the DVD player before he acquires more debt.

Activity 8 – 4: Understanding a budget

1. a) The fraction of total expenditure to be spent on clothes $= \frac{180}{920} = \frac{9}{46}$

   b) $\frac{9}{46} \times 100 = 19{,}56\%$

   c) $\frac{800}{1050} = \frac{16}{21}$, and as a percentage of the total income $= \frac{16}{21} \times 100 = 76{,}19\%$
2. Learner-dependent answer, but all the costs listed in the advertisement must be included.
3. a) **OPTION 1:**

	Income	Expenses	Running total
Money from parents	500		500
Savings	2000		2500
Bus fare		1200	1300
Meals on bus		$3 \times 30 = 90$	1210
Accommodation		0	1210

OPTION 2:

	Income	Expenses	Running total
Money from parents	500		500
Savings	2000		2500
Bus fare		400 + 500 = 900	1600
Meals on bus		$6 \times 30 = 180$	1420
Accommodation		200	1220

   b) Although the bus fare for Option 2 was cheaper the costs are quite similar in the end. Option 1 is much more convenient and is quicker, so he should choose this option.

Activity 8 – 5: Understanding a statement

1. a)

Expenses	Amount	Running total
Bus Fare	R 1200 + R 168 VAT	R 1468
Meals on bus	R 90	R 1558
Backpacker's accomodation	R 200	R 1758
Locker	R 20	R 1778
Meals	R 30 $\times$ 2 = R 60	R 1838

b) He has R 2000 saved and receives R 500 from his parents. R 2500 − R 1838 =R 662 to spend in Durban.

2. a)

	Income	Expenses
State pension	R 1140	
Disability grant	R 1140	
Salary	R 5250	
Rent		R 2300
Transport		R 520
Cell phone		R 200
Pre-paid electricity		R 800
Water bill		R 350
TV contract		R 250
Loan repayment		R 310
Furniture store account		R 570
Clothing store account		R 315
Groceries		R 2500
Medical expenses		R 75 + R 500 = R 575
Total	**R 7530**	**R 8690**

b) R 8690 - R 7530 = R 1160 more for expenses than they receive in income.

c) Water and electricity usage could be reduced, the furniture and store accounts could be paid off and closed, and grocery expenses could be reduced.

d) Probably. They aren't thousands of Rands over budget so a series of small reductions across their expenses would bring their expenses in line with their income.

e) Learner-dependent answer, but examples include reducing water and electricity consumption and paying off and closing the clothing and furniture store accounts.

Activity 8 – 6: End of chapter activity

1. Clothes: R 200, Entertainment: R 150. Fixed savings account: R 50. Transport: R 25. Donations: R 25. Tuck shop spending: R 50.
2. Clothes: R 450. Entertainment: R 720. Transport: R 180. Tuckshop spending: R 270. Donations: R 90. Unforeseen costs: R 90.
3. a) 20 $\times$ R 500 = R 10 000

b) R 2500

c) R 5500

d) R 2500 + R 250 = R 2750

e) R 800 + R 96 = R 896

f) R 1200 × 2 = R 2400

g) Taxi fare: R 10 per day × 2 children × 20 days = R 400. Petrol: (20 × 4 litres × R 10,50) + (10 × 3 litres × R 10,50) = R 840 + R 315 = R 1155

h) Total salaries = R 19 500. 5% of this is R 975.

i) 5% of R 9500 = R 475.

j) Total income = salaries + additional income = R 19 500 +R 2500 = R 22 000. 5% of this is R 1100.

k) (550 × R 0,50) =R 275

l)
  i. R 135
  ii. (100 × R 0,80) + (200 × R 0,40) = R 160

m)
  i. R 400
  ii. (350 × R 0,50) + (R 7 × 20) = R 315.

n) The total for fixed expenses is R 12 456. The total for variable expenses is R 5630. So the total for all expenses is R 18 086. The total income for the household is R 22 000, so yes - they are within budget, because their income is greater than their total expenditure and they have a surplus of money.

9 Perimeter and area

Activity 9 – 1: Measuring and estimating perimeter

1. a) Perimeter = 5 cm + 5 cm + 5 cm + 5 cm = 20 cm
   b) Perimeter = 40 mm + 55 mm + 68 mm = 163 mm
   c) Circumference ≈ 47 mm.
2. Perimeter = (3 sides of rectangle) + half circle ≈ (4,5 cm + 3 cm + 4,5 cm) + 4,5 cm = 16,5 cm

Activity 9 – 2: Using formulae to calculate perimeter

1. a) Perimeter triangle = length + length + length = 400 cm + 6 m + 7,2 m = 4 m + 6 m + 7,2 m = 17,2 m
   b) Perimeter = sum of sides = 7 m + 1,5 m + 150 cm + 1,5 m + 1 m + 5000 mm + (1 m + 1,5 m + 7 m) + 5000 mm = 7 m + 1,5 m + 1,5 m + 1,5 m + 1 m + 5 m + 9,5 m + 5 m = 32 m

c) Perimeter square = 4 × side = 4 × 2 m = 8 m

d) Circumference = $\pi \times$ (2× radius) = $\pi \times$ (2 × 1,5 m) = 3,142 × 2 × 1,5 m = 9,426 m ≈ 9,43 m

e) Perimeter rectangle = 2 × length + 2 × width = (2 × 20 m) + (2 × 15 m) = 40 m + 30 m = 70 m

2. a) Perimeter of playground is 17,2 m. 17,2 ÷ 0,5 m = 34,4 litres of paint.

b) 34,4 litres ÷ 2,5 litres = 13,76. So they need to buy 14 tins of paint.

3. a) 8 m ÷ 1,5 m = 5,333. They can't buy a third of a segment so they will have to buy 6 segments.

b) 6 × R 145,50 = R 873.

Activity 9 – 3: Using formulae to calculate area

1. a) $\frac{1}{2}$ base × height = $\frac{1}{2}$× 6 m 4× 4 m = 12 m^2

b) 12 m^2 ÷ 1,5m^2 = 8 bags

2. a) Area = $\pi r^2 = \pi(1{,}5\ \text{m})^2 = 7{,}07\ \text{m}^2$

b) 7,07 ÷ 1,5 = 4,713 bags. So they will have to buy 5 bags.

c) 5 × R 60,75 = R 303,75

3. a) Area = 2 m × 200 cm = 2m^2

b) 1 bag.

4. a) 2 m ÷ 50 cm = 2 m ÷ 0,5 m = 8. He can plant 8 rows of seedlings.

b) 8 × R 12,95 = R 103,60

c) Total area = 16 m^2. 1 m^2 ÷ 16 m^2 = 0,0625. 0,0625 × 100 = 6,25%

5. a) Area = Area rectangle + area square = (5 m × (7 + 1,5 + 1,5 m)) +(1,5 × 1,5 m) = 50 m^2 + 2,25 m^2 = 52,25 m^2

b) 52,25 m^2× R 73,49 = R 3839,85

6. a) Area of entire property = 15 m × 20 m = 300 m^2. R 10 000 ÷ 300 m^2 = R 33,33 per m^2

b) R 10 000 × 12 months = R 120 000

Activity 9 – 4: Area and cost calculations

1. a) Area = (20 m) × 4 m + 8 m) = 20 m × 12 m = 240 m^2

b) Area = $\frac{1}{2}$× 20 m × 4 m = 40 m^2

c) $\frac{40}{240}$ = 0,16666. 0,16666 × 100 = 16,67%

2. a) Area $= 3{,}142 \times (1{,}5 \text{ m})^2 = 7{,}07 \text{ m}^2$

   b) Area = area rectangle + area semicircle $= (2 \text{ m} \times 1 \text{ m}) + \frac{1}{2}(\pi \cdot (1 \text{ m})^2) = 2 \text{ m} + 1{,}57 = 3{,}57 \text{ m}^2$

   c) The second design is much smaller than the first. If he is concerned that the pond will be too large, he should decide on the second shape.

3. **Pond shape 1 (circle):** cost = Labour + fencing price × perimeter = R 549,99 + (R 29,99)($2\pi \times$ 1,5 m) = R 549,99 + R(29,99)(9,426 m) = R 549,99 + R 282,69 = R 832,68.

   Pond shape 2: Cost = Labour + fencing price × perimeter = R 549,99 + (R 29,99)(2 m + 1 m + 2 m + $\frac{1}{2} \times 2 \times \pi \times$ 1 m) = R 549,99 + (R 29,99)(5 m + 3,142 m) = R 549,99 + R 244,18 = R 794,17

4. Learner-dependent answer, but based on his concern about the size of the pond he should choose the second design - it's cheaper to fence too.

5. a) Area of patio = 6 m × 8 m = 48 m^2. Area of cobblestone = 0,1 m × 0,1 m = 0,01 m^2. $48 \div 0{,}01^2$ = 4800 cobblestones.

   b) 4800 ÷ 200 = 24 batches of cobblestones.

   c) 24 × R 129,99 = R 3119,76

6. a) i. Perimeter of pool = 2 × (8 m + 4 m) = 24 m
      ii. Length of fencing = 2 × (10 m + 6 m) = 32 m
      iii. Area of pool = 8 m × 4 m = 32 m^2
      iv. Cost of fence = R 250,00 × 32 m = R 8000
      v. Cost of netting = R 199,99 × 32 m^2 R 6399,68

   b) i. Perimeter of pool = $2\pi r$ = 2 × 3,142 × 3,5 = 21,99 m
      ii. Length of fencing = $2\pi(4{,}5 \text{ m})$ = 28,28 m
      iii. Area of pool = πr^2 = 3,142 × $(3{,}5 \text{ m})^2$ = 38,49 m^2
      iv. Cost of fence = R 250,00 × 28,28 m = R 7070
      v. Cost of netting = R 199,99 × 38,49 m^2 = R 7697,62

   c) i. Perimeter of pool = 2(perimeter of semi-circles) + length of 2 rectangular sides = (perimeter one circle with radius 2 m) + 2(7 m) = $2\pi(2\text{m})$ + 14 m = 12,568 m + 14 m = 26,57 m
      ii. Length of fencing = 2(perimeter of semi-circles) + length of 2 rectangular sides = (perimeter one circle with radius 4 m) + 2(7 m) = $2\pi(4\text{m})$ + 14 m = 25,136 m + 14 m = 39,14 m
      iii. Area of pool = Area rectangle + 2(area semi-circles) = Area rectangle + (area cricle radius 2 m) = (7 m × 4 m) + $(\pi(2)^2)$ = 28 m^2 + 12,568 m^2 = 40,57 m^2
      iv. Cost of fence = R 25,00 × 39,14 m = R 9785
      v. Cost of netting = R 199,99 × 40,57 m^2 =R 8113,59

7. a) Area = (Area small rectangle) + (area big rectangle) = (4,7 m × 4,3 m) + (10,8 m × 12,8 m) = 20,21 m^2 + 138,24 m^2 = 158,45 m^2

   b) Rate per year = Area × R 15,05 = 158,45 m^2 × R 15,05 = R 2384,6725 per year. Per month = R 2384,6725 ÷ 12 = R 198,72 per month.

8. a) Area = $\frac{1}{2}$(2,4 m)(90 cm) = $\frac{1}{2}$(2,4)(0,9 m) = 1,08 m^2

b) Area = (Area of rectangle) - (area of triangle) = [(80 + 90 + 80 cm) × (1,2 + 2,4 + 1,2 m)] - 1,08 m^2 = [2,5 m × 4,8 m] - 1,08 m^2 = 12 m^2 -1,08 m^2 = 10,92 m^2

c) 10,92 m^2 × R 24,65 = R 269,18

d) No. We do not know the length of the third side of the triangle so we cannot calculate the perimeter.

9. a) Area of triangle = $\frac{1}{2}$× base × height = $\frac{1}{2}$(2,63 m)(2,1 m) = 2,76 m^2

b) 2,76 m^2÷ 0,5 m^2 = 5,52 litres of paint

c) 5,52 ÷ 2 = 2,76 tins. He cannot buy 0,76 of a tin, so he will have to buy 3 tins.

10 Assembly diagrams, floor plans and packaging

Activity 10 – 1: Wiring a plug

1. The green and yellow wire.
2. The blue wire.
3. The brown wire.
4. A 2 prong plug only has two wires, unlike a 3 prong plug, which has 3 wires. A two prong plug is also not earthed.
5. Appliances that aren't wired correctly can short, and shock you if you touch them. This can be fatal!

Activity 10 – 2: Making a paper glider

1. Learner-dependent answer but descriptions should be clear and concise.
2. Advantage: you don't have to translate the instructions into another language. Disadvantage: Sometimes words can add meaningful explanations to the instructions, so pictures only can be less easy to understand.
3. Learner-dependent answer.
4. Learner-dependent answer.
5. Learner-dependent answer.

Activity 10 – 3: Understanding floor layout

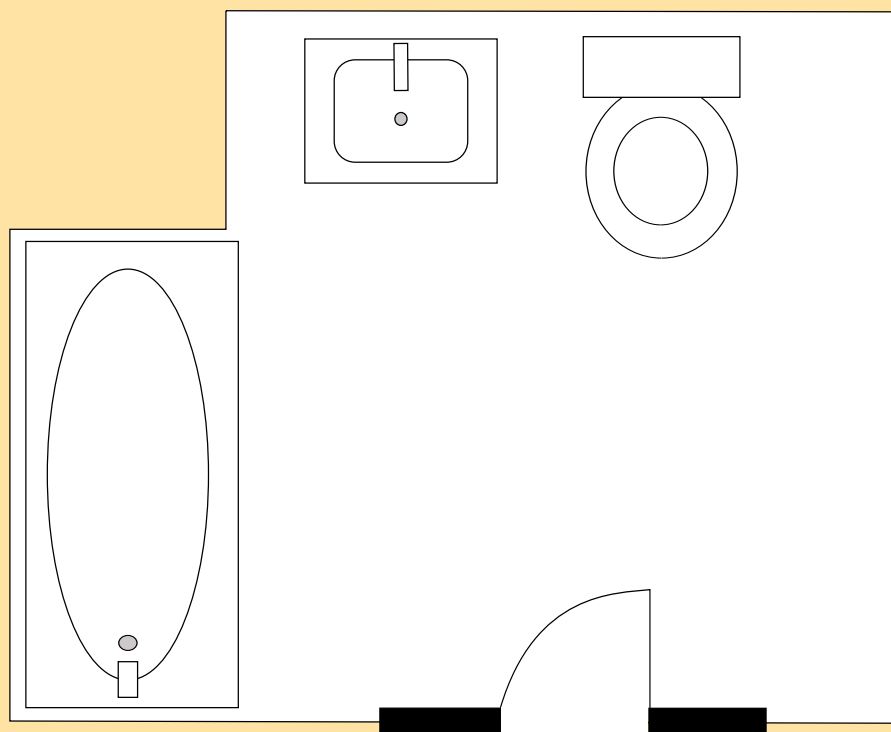
1. a) In Diagram 1 the stove is almost behind the open door, so every time a person turns around from the stove, they will be bumping into the door.

   b) If there are curtains or blinds over the window this could become a fire hazard if something cooking on the stove caught alight.

   c) Diagram 2: The fridge and work surface are close to the stove.

   d) Diagram 1: the area for plates and bowls is close to the sink so it is easy to put dry dishes away.

   e) Learner-dependent answer.

2. a)

   b) Place the window above the bath. The other two walls are inside the house.

Activity 10 – 4: Working with scaled floor plans

1.

	Measurement on the plan	Calculation	Measurement in real life
Length of the classroom	13 cm	13×100 cm = 1300 cm	1300 cm$\div$100 cm = 13 m
Width of the classroom	8 cm	8×100 cm = 800 cm	800 cm$\div$100 cm = 8 m
Length of the checkered rug	3 cm	3×100 cm = 300 cm	300 cm$\div$100 cm = 3 m
Width of the checkered rug	2 cm	2×100 cm = 200 cm	200 cm$\div$100 cm = 2 m

2. New rug: Area $= \text{length} \times \text{width} = 3\text{ m} \times 2\text{ m} = 6\text{ m}^2$

3. Cost per $\text{m}^2 = \text{R } 800 \div 6\text{ m}^2 = \text{R } 133{,}3333\ldots = \text{R } 133{,}33$ per m^2

Activity 10 – 5: Investigating packaging arrangements

1. Learner-dependent answer.
2. Learner-dependent answer.
3. Learner-dependent answer.
4. Learner-dependent answer.
5. Learner-dependent answer.
6. Learner-dependent answer.

Activity 10 – 6: End of chapter activity

1. a) 5 pieces
   b) 4 wheels
   c) 12 screws
   d) He will need a screwdriver and possibly a hammer
   e) 1. Screw the cabinet top support piece into the left side panel of the cabinet. 2. screw the top support piece into the right side panel of the cabinet. 3. Attach the top of the cabinet to the sides, screwing it in. 4. Slide the bottom piece into the cabinet. Screw it in place. 5. Attach the wheels to the base of the cabinet. 6. The cabinet assembly is complete!
   f) Yes. Robert could assemble it in a different order (e.g. he could put the bottom piece in before the top piece) but it will probably be more difficult.
2. a) Stove, kitchen sink, couches, doors, windows, toilet, bath, basin, bed etc.
   b)

	Measurement on plan	Calculation	Measurement in real life
Bath (width)	1,5 cm	1,5 cm × 50	75 cm
Bath (length)	3,5 cm	3,5 cm × 50	175 cm
Main bedroom window (length)	4 cm	4 cm × 50	200 cm
Kitchen sink (width)	3 cm	3 cm × 50	150 cm
Bedroom (length)	12 cm	12 cm × 50	600 cm
Bedroom (width)	5 cm	5 cm × 50	250 cm

c) Dimensions $= 600$ cm $\times$ 250 cm $= 6$ m $\times$ $2{,}5$ m $= 15$ m^2

d) 15 m^2 $\div 3 = 5$ boxes. $5 \times$ R 120 $=$ R 600

e) Dimensions of flat $= 12 \times 15$ cm $= 50(12 \times 50) = 600$ cm $\times$ 750 cm $=$ 6 m $\times$ $7{,}5$ m. So area $= 45$ m^2. R 90 $\times$ 45 m^2 $=$ R 4050

f) Door is 1,5 cm wide. $1{,}5 \times 50 = 75$ cm. No - the new couch will not be able to fit through the front door.

3. a) The stove is under the window (fire hazard if there are curtains), the door opens into the table and chairs, The fridge is inaccessible, there is a lamp in the middle of the floor and a pot plant in the middle of the floor.

   b) Learner-dependent answer, but all the objects in the original diagram must be included and the layout problems must be resolved.

4. a) There are a number of combinations that can be used (e.g. vertically, horizontally, long side parallel or perpendicular to width of box).

   b) $2{,}5$ kg $= 2500$ g. $2500 \div 100$ g$=$ 25 chocolates.

   c) $25 \times$ R 11,99 $=$ R 299,75

   d) Total cost $=$ cost of chocolates $+$ cost of box $+$ cost of shipping $=$ R 299,75 $+$ R 10,00 $+$ (R 40 $\times$ 2,5 kg) $=$ R 409,75

   e) Triangular prisms are easier to pack because they have flat sides, so there will not be gaps between the chocolates.

11 Banking, interest and taxation

Activity 11 – 1: Understanding a bank statement

1. As payments (debits) and deposits (credits) respectively.

2.

Date	Transaction	Payment	Deposit	Balance
27/02/2013	OPENING BAL			2304,85
1/03/2013	INTEREST ON CREDIT BALANCE		13,95	2318,80
1/03/2013	CHEQUE (SALARY)		2100,00	4418,80
1/03/2013	ATM CASH	400,00		4018,80
5/03/2013	ATM CASH	800,00		3218,80
10/03/2013	ATM DEPOSIT		600,00	3818,80
22/3/2013	SPENDLESS DEBIT CARD PURCHASE	235,95		3582,85

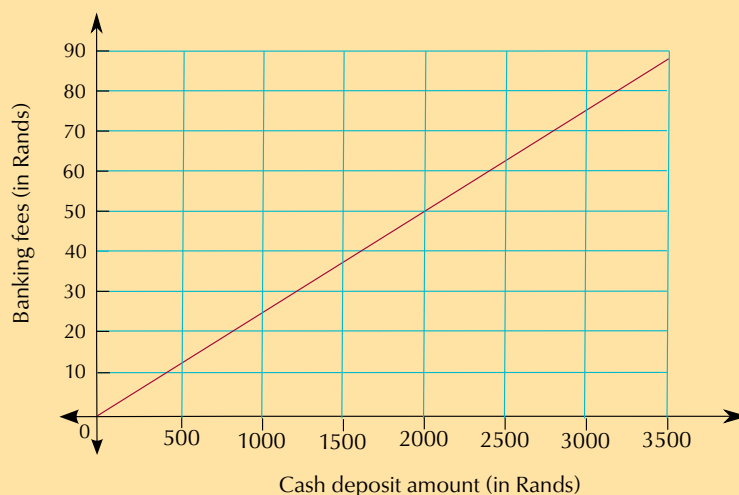
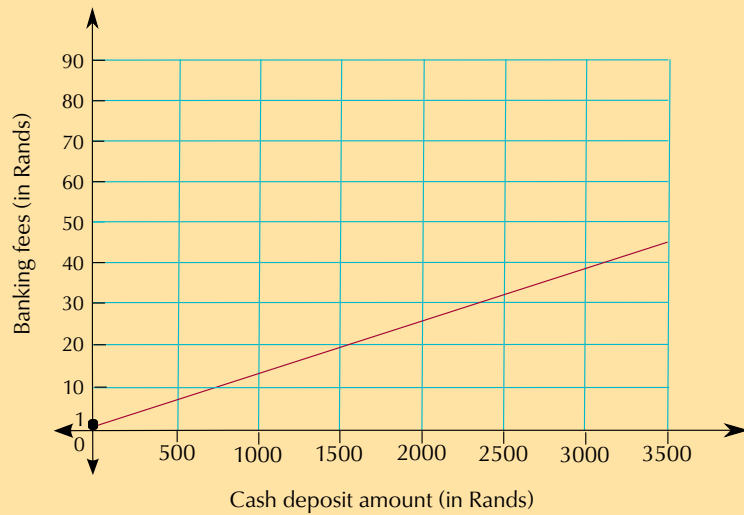
3. R 3582,95

4. Yes.

Activity 11 – 2: Calculating banking fees

1. a) Three.
   b) R 847,21 + R 149,59 = R 995,80
   c) Returned debit order: R 4,00. Cash withdrawal at Shoprite: R 1,00. Old Mutual debit order payment at branch: R 3,00. Capital Bank ATM withdrawal: R 4,00. FNB ATM withdrawal: R 7,00. Balance query in branch: R 3,00. Monthly admin fee: R 4,50. 8 SMS notifications: R 3,20. Total: R 29,70
   d) She could do away with SMS notifications, only draw cash at tillpoints, make sure her debit orders don't get returned and so on.
2. a) i. R 2,50 + R 4,275 = R 6,78
   ii. R 2,50 + R 1,11 = R 3,61
   iii. R 2,50 + R 61 750 = R 61 752,50
   b) R 2,50 + R 3,0875 = R 5,59. Yes, it was calculated correctly.
3. a) R 0,90 × 5 parts of R 100 = R 4,50
   b) R 0,90 × 7 parts of R 100 = R 6,30
   c) R 0,90 × 36 parts of R 100 = R 32,40
4. R 2,35 + 3 × R 1,15 = R 5,80
5. R 2,45 + (0,85% of R 875) = R 2,45 + R 7,44 = R 9,99
6. R 1,20 + (6 × R 0,75) = R 5,70
7. a) It is cheaper to use the ATM. If you deposited R 200, for example, the bank fees would be R 1 + R 2,40 = R 3,40. The same deposit at a teller would cost R 5,00. It is cheaper to deposit the cash at an ATM, because the process is automated and does not involve a skilled employee.
   b)

Deposit amount (R)	500	1000	1500	2000	2500	3000	3500
Fee at teller	R 12,50	R 25,00	R 37,50	R 50,00	R 62,50	R 75,00	R 87,50
Fee at ATM	R 7,00	R 13,00	R 19,00	R 25,00	R 31,00	R 37,00	R 45,00

   c)

d) Approximately R 15

Activity 11 – 3: Understanding interest

1. No.
2. Balance = Cash Price - Deposit = R 15 600 - R 1560 = R 14 040
3. It will be charged on the account balance.
4. R 356,24
5. Total Payable = Deposit + (Installment amount × number of installments)
   = 1560 + (356,24 × [(12 × 5)] = R 1560 + R 21 374,40 = R 22 934,40
6. $\frac{\text{Total interest payable}}{\text{Value}}$ = (Installment amount × number of installments) − Balance
   = R 356,24 × [12 × 5] − 14 040
   = R 21 374,40 − R 14 040 = R 7334,40

Activity 11 – 4: Calculating VAT and checking till slips

1. a) = R 8,76 + R 8,76 + R 21,92 + R 6,13 + R 0,35 + R 17,54 + R 24,55 + R 28,06 = R 116,07
   b) = R 19,99 - R 17,54 = R 2,44
   c) = R 27,99 - R 24,44 = R 3,55
   d) = R 31,99 - R 28,06 = R 3,93
   e) = R 132,01 - 116,07 = R 15,94

f) = R 21,92 + R 3,07 = R 24,99

g) = R 6,13 + R 0,86 = R 6,99

h) = R 0,35 + R 0,05 = R 0,40

2. They have rounded numbers off differently. Nthabiseng incorrectly rounded down her answer of 16,2498 to 16,24.

3. VAT exempt items total: R 67,95. VAT inclusive items total: R 22,78. VAT is 14% of R 22,78 = R 3,19. Total VAT is R 3,19. Total balance due is R 67,95 + R 22,78 + R 3,19 = R 93,92.

Activity 11 – 5: End of chapter activity

1. a) R 3,30 + 4 × R 1,20 = R 8,10

   b) Free

   c) R 3,30 + 30 × R 1,20 = R 15,30

   d) R 3,30 + 3 × R 1,20 = R 6,90

2. a) R 3,75 + 3 × R 0,75 = R 6,00

   b) R 3,75 + 9 × R 0,75 = R 10,50

   c) 3,75 + 29 × R 0,75 = R 25,50. This exceeds the maximum charge or R 25, so the bank charge will be R 25,00.

3. a) R 3,50 + 25 × R 1,10 = R 31,00

   b) R 5,50 + R 3,50 + 8 × R 1,10 = R 17,80

   c) R 23,00 + 3 × R 1,10 = R 26,30

   d) $\frac{26,30}{250} \times 100 = 10,52\%$

   e) At the bank: R 23 + 15 × R 1,10 = R 39,50.
   At a TownBank ATM: R 3,50 + 15 × R 1,10 = R 20,00.
   At a tillpoint with a purchase: R 5,50.
   So it will be cheapest to draw at a tillpoint, with a purchase.

4. a)

Amount invested in Rands	100	200	300	400	500	600	700
Interest Earned in Rands	10	20	30	40	50	60	70
Interest/Amount × 100 (Interest Rate)	10%	10%	10%	10%	10%	10%	10%

   b) Direct proportionality.

   c) Interest rate is fixed at 10%. 10% of R 10 000 = R 1000 of interest earned.

5.

Amount (R)	17,95	100,00	10,00	33,80	4,50	193,86	354,39
VAT (R)	2,51	14,00	1,4	4,73	0,63	27,14	49,61
Total (R)	20,46	114,00	11,40	38,53	5,13	221,00	404,00

Activity 12 – 1: Deciding on the best way to collect data

1. a) Questionnaire or observation.
   b) Questionnaire.
   c) Questionnaire or database (if this info is recorded, e.g. for Physical Education)
   d) Interview.
2. a) Learner-dependent answer.
   b) Learner-dependent answer.
   c) Learner-dependent answer.

Activity 12 – 2: Developing a questionnaire

1. Learner-dependent answer.

Activity 12 – 3: Calculating the mean

1. a) Mean $= 13{,}18$
   b) Mean $= 3{,}5$
   c) Mean $= 26{,}67$
   d) Mean $= 185{,}67$
2. Mean $= 174{,}18$
3. Mean $= 6{,}29$
4. Mean $=$ R 39,50
5. a) Mean $= 10{,}35$ minutes
   b) Mean $= 16{,}7$ years

Activity 12 – 4: Calculating the mean, mode, median and range

1. a) Mean: 13,18. Mode: 5. Median: 10. Range: $24 - 5 = 19$.

b) Mean: 202,33. Mode: none. Median: $\frac{202+208}{2} = 205$. Range: 215 - 187 = 28.

2. Mean: 174,18 cm. Mode: 176 cm. Median: 175 cm. Range: 215 - 187 = 23 cm.

3. a) Mean: 34,1. Mode: 32. Median: 32. Range: 81 - 6 = 75.

   b) Mean: 212,56. Mode: none. Median: 214. Range: 325 - 124 = 201.

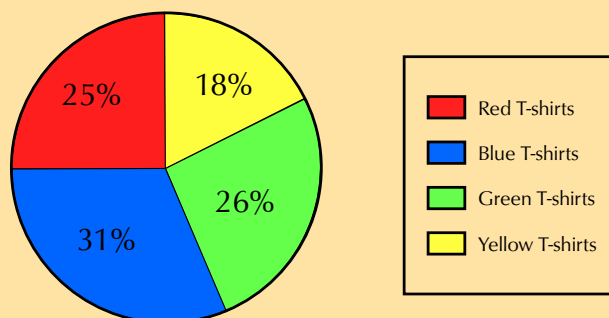
4. a) Mean: 16,7. Mode: 19. Median: 19. Range: 25 - 3 = 22.

   b) It would affect the mean and the range. The mode and median would still be 19, however.

Activity 12 – 5: Understanding pie charts

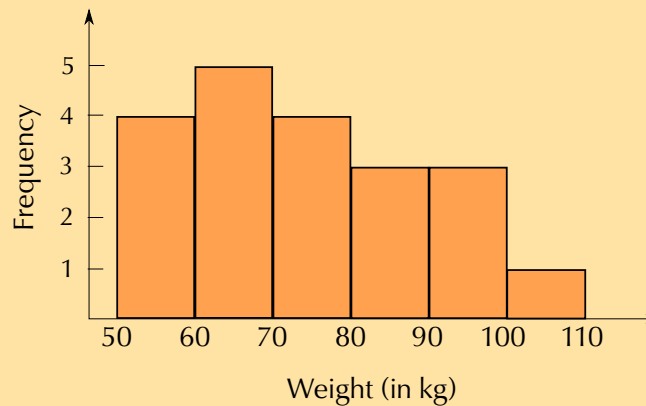
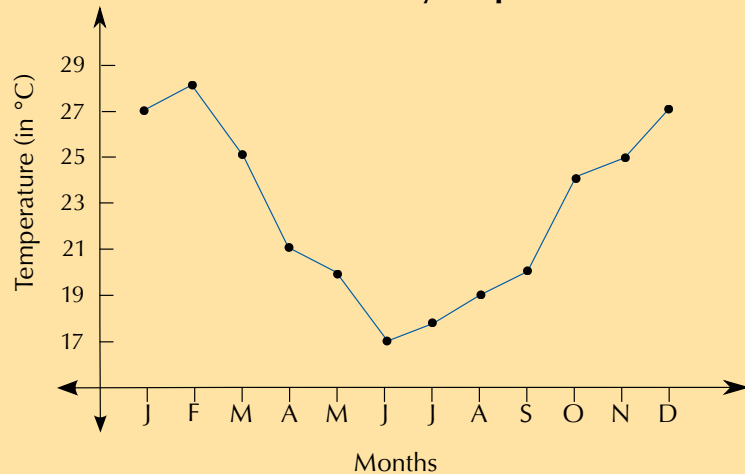
1. Level 2.
2. 40 percent of learners obtained this level.
3. 2%
4. 15% of 120 learners = 18 learners who obtained level 4.
5. 20 : 40 = 1 : 2.

Activity 12 – 6: Representing data

1.

2. a)

Interval (in kg)	Frequency
50 - 59	4
60 - 69	5
70 - 79	4
80 - 89	3
90 - 99	3
100 - 109	1

b)

3. a)

b) The maximum temperature drops towards the middle of the year, as we would expect during winter.

4. a) 45% of 120 learners = 54 learners who chose fruit cocktail. 30% of 120 = 36 learners who chose litchi. 12,5% of 120 learners = 15 learners who chose grape. 12,5% of 120 = 15 learners who chose apple juice.

b) The pie chart is a simple, visual representation that works well for representing percentages. A pie chart allows us to see at a glance the relative proportions of the learners who prefer each flavour.

c) The number of learners who prefer each flavour.

5. a) No. It may look like there are 140 learners in total but we have no way of knowing if that is correct or just an arbitrary number. Also, learners take more than one subject, so we can't use the numbers of learners per subject to determine how many learners there are altogether.

b) No, we cannot assume this.

c) Learners do not only take one subject, therefore the data cannot be split into discrete percentages per subject and represented using a pie chart.

Activity 12 – 7: The whole data handling cycle

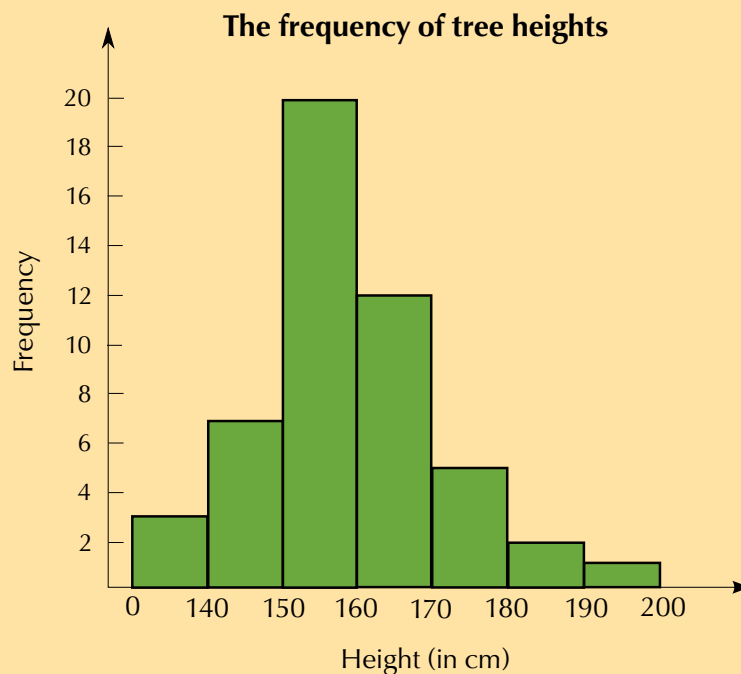
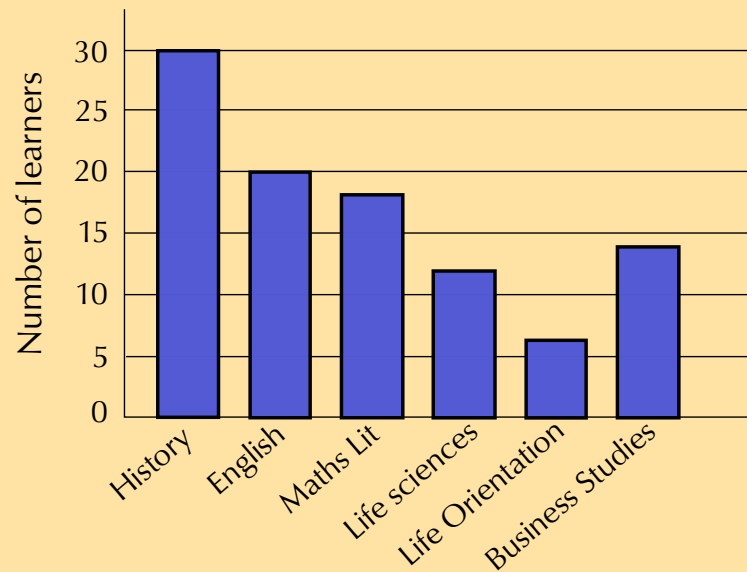
1. Learner-dependent answer.
2. Learner-dependent answer.
3. Learner-dependent answer.

Activity 12 – 8: End of chapter activity

1. a) Learner-dependent answer.
   b) Learner-dependent answer.
   c) Learner-dependent answer.
2. a) 16; 22; 25; 27; 35; 37; 40; 41; 42; 45
   b) Mean = 33,18
   c) Median = 35.
   d) Mode = 35.
   e) Range = 45 - 16 = 29.
   f) $\frac{33{,}18}{50} \times 100 = 66{,}36\% = 66{,}4\%$
3. a)

b) 150 - 159 cm

c) 190 - 199 cm

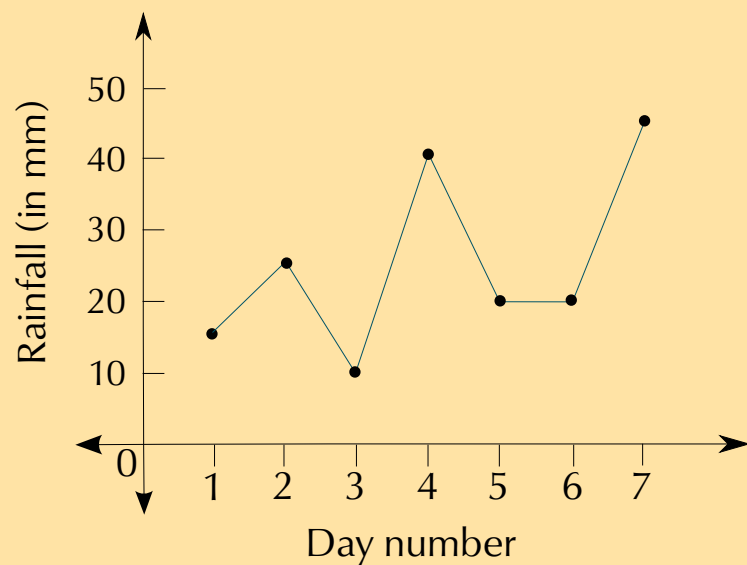
4. a)

b) History is the most popular subject. This could be because students like the history teacher the most.

5. a) Mean = 25 mm.

b) Mode = 20 mm.

c) Median = 20 mm.

d) Range = 40 - 10 = 30 mm.

e)

6. a) Comedy movies.

b) 27%

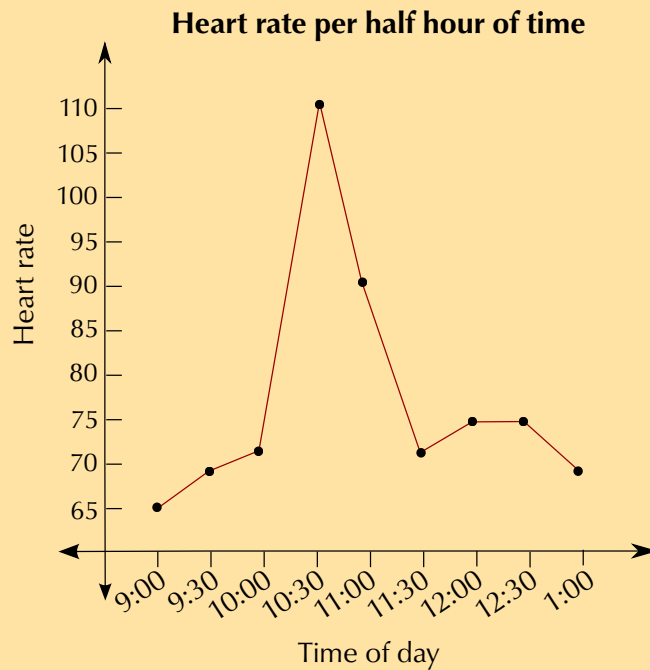
c) Romance and Drama movies, and Foreign and Science Fiction movies

d) i. 18% of 200 people is 36 people.

ii. 8% of 200 people is 16 people.

e) 18 : 8 = 9 : 4

f) There may be less science fiction and foreign movies made or screened, or they may simply be less popular.

7. a)

b) Melissa's heart rate increases suddenly at 10:30 a.m. Apart from this spike, it is fairly consistent, within a small range.

c) It may have increased if she exercised - e.g. if she went for a walk or a run.

List of Definitions

Image Attribution

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GRADE 10

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